AVIATION

The Oldest American Aeronautical Magazine

MAY 30, 1927 | Issued Weekly | PRICE 15 CENTS

Capt. Charles A. Lindbergh and plane in which he flew to Paris.

P. & A. Photo

VOLUME XXII

NUMBER 22

SPECIAL FEATURES

NEW YORK-PARIS FLIGHT A REALITY
THE RECENT AIR RECORDS
THE GLENN MARTIN THREE-PURPOSE PLANE

AVIATION PUBLISHING CORP.
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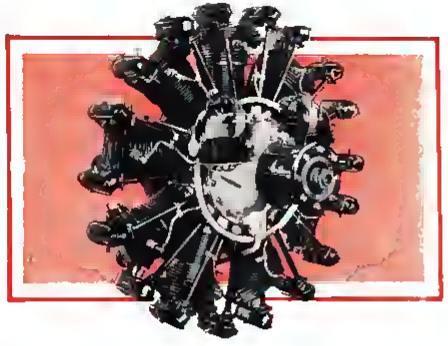

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Won 2nd place Annual Reliability Tour in Buhl Verville Airster carrying 800 lbs. pay load, average speed 113.5 m.p.h.

Won 3rd place Annual Reliability Tour in Stinson Detroiter carrying 640 lbs pay load, average speed 106.7 m.p.h

Won Transport Race for Detroit News Air Transport Trophy at Philadelphia in Wright Bellanca carrying 1,607 lbs ballast at 121.53 m.p.h

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Won 12 out of 18 prizes they competed for at Philadelphia

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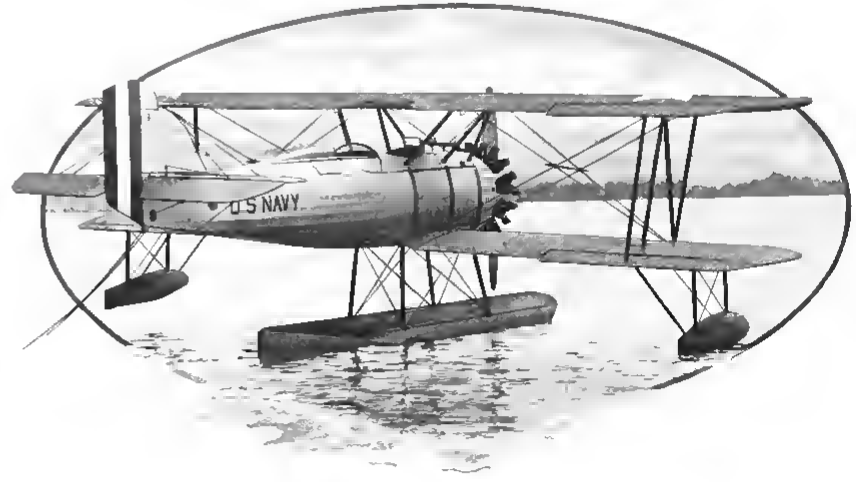

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With the Editor

At a time when so many outstanding aviation performances are being set up, culminating in the remarkable flight of Capt. Charles A. Lindbergh across the Atlantic Ocean, it is peculiarly easy to think out milestones in aeronautical development which are indicated by such achievements. However, no outstanding trend of development is more apparent at the present time than that of the air-cooled radial engine. Not only did Captain Lindbergh depend very largely upon the reliability of his Wright Whirlwind engine in his great accomplishment but as is brought out in this issue of AVIATION by a capable observer of aeronautical progress, all of the recently set up world records have been made with aircraft fitted with another well known example of the air-cooled radial engine development, the Pratt & Whitney Wasp.

When, in the future, this period of aeronautical history is looked back upon it may well be characterized as the "air-cooled powerplant age"—the period when this class of engine definitely and very illustriously established itself as a sound and reliable development having outstanding advantages.

AVIATION

The Oldest American Aeronautical Magazine

VOL. XXII MAY 30, 1927 No. 22

Worldwide Aviation Interest

THAT THE widespread interest in aviation which is so characteristic of the present time in the United States, is by no means solely confined to this country, is very apparent from a perusal of the Foreign Aeronautical Review chapter of the 1927 Aircraft Year Book, published by the Aeronautical Chamber of Commerce. Commenting upon the fact that "it is difficult to point out any one country in which there is not to be found some rapidly developing aeronautical interest", the Year Book continues to a general discussion of the aeronautical activities of no less than forty-seven countries of the World, indicating in a very startling manner the extensive interest and, in fact, widespread activity that exists at this time in aviation.

Furthermore, it is significant to note that for the most part this activity, as reported in the Year Book, is mainly in the realms of civil aviation. Of course, it is well known that most of the nations of the World possess some form of air defense force—such is inevitable in view of the close competition which continues to exist among even the smallest countries in the matter of defense—but that civil aviation activity should be so Worldwide is a matter, not only for general satisfaction but of deep significance.

Commercial air transportation, like almost all forms of travel and transport, is accumulative in its development. That is to say, the more it extends the more it will have to extend to meet demands and needs created by its own influence. Furthermore, the Worldwide development of air transportation is somewhat analagous to the development of air traffic in, for example, the United States alone. The sooner cities and municipalities all over the country create suitable airports and cater for the arrival of commercial aircraft the sooner will we have the country crisscrossed with trunk air routes over which regular air services are maintained. Just in the same manner, the sooner the numerous nations of the World, particularly the smaller ones take an active and progressive interest in civil aviation, the sooner will it be possible for the bigger countries, and these may be expected to take the lead, to establish regular trunk air services over the long distance airways of the World.

The future of commercial aviation depends to a large extent upon such a development. With the growth of air transport, and the education of the public in the great advantage to be derived from its application to business and industry in general, the day is not far distant when every large city in the world must feel it a duty to its citizens to have an airport.

Lindbergh

The plaudits of the World are being received by a representative of the aircraft fraternity. In all the realm of sport or science or adventure no greater honor has ever come to an individual. He has triumphed over fate with a cool determination that has made his name synonomous with courage and daring in every country on the globe. He has raised the art which he so skillfully practices to the pinnacle of scientific achievement. Pathfinders from the days of Marco Polo and Columbus have taken their places in the niches of history. Exploration by ship is no longer possible. The airplane is bringing with it a new field for discovery, exploration and achievement. Lindbergh's spanning of the North American continent and the Atlantic will set a mark for future aircraft long distance records that will be difficult to surpass. Six thousand two hundred miles in three hops is a mark that will be worthy of the best airmanship of the world.

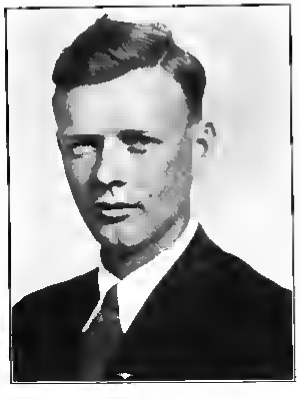
During the days when aviation development seemed to lag and at times become immobile, there were those whose vision saw beyond the present and beheld a future that would richly repay their efforts toward the perfecting of air travel. To those pioneers who had the faith in aviation, the achievement of Captain Lindbergh must come with two fold significance—the satisfaction in knowing that their belief was founded on common sense and the thought that it is but a symbol of greater attainments still to be chronicled. Today, even to the most optimistic enthusiast, it ranks beyond any success in this field, and most others, of which he knows. As it recedes with the years and in the perspective of time future generations are called upon to value it, it will be ranked as one of the great milestones marking the progress of the race.

To the general public so long skeptical of the feasibility of the airplane for long flights, the success of this young American must come as a revelation. Whatever the mental attitude toward the subject of aviation may have been, the reaction of the people of the earth to that brilliant exploit of May 20 21 must surely bring a change in feeling when the first effects of surprise and admiration have faded. Sober consideration will tell them that one man's demonstration of today in the practicability of spanning by air enormous distances in the space of hours in safety, will be the privilege of all men in time to come through the ability, courage and determination of such as Captain Lindbergh and those who supported him in equipment and financial backing.

New York-Paris Flight a Reality

Capt. Charles A. Lindbergh Makes First Successful Non-Stop Flight. Feat Stirs World.

Owing to AVIATION *having to go to press immediately after the great achievement of Captain Lindbergh, it is only possible to give the news features of this epoch making flight in this issue. In a later issue the technical details of the great venture will be given fully*—ED.



Capt. Charles A. Lindbergh.

Lindbergh a plane well away

CAPT. CHARLES A. LINDBERGH, the St Louis air mail pilot, upon whom the attention of the World has been focused since he followed his announcement that he would fly from New York to Paris, by his remarkable flight from San Diego, Cal, to St Louis, Mo., and from this latter city to New York, hopped off from Roosevelt Field, L. I., at 7 52 a.m., Friday, May 20, and at 10:24 p.m, Saturday, May 21 Paris Time (4:24 p.m Eastern Standard time) landed at Le Bourget air field, near Paris, France. The 3,610 mile flight was made in 33½ hours, his average time being about 108 m.p.h.

On Jan. 21, Captain Lindbergh sent the following telegram to AVIATION:

Wire collect terms of prize for the New York-Paris Flight, stating method of entry.

AVIATION in reply referred Captain Lindbergh to the Secretary of the Trustees of the Raymond Orteig Prize, giving him the address in New York City

Thus four months ago began the project which culminated in the greatest single feat in aviation history.

Captain Lindbergh decided to start the flight just before midnight on Thursday, May 19. At that time a heavy fog had settled over Roosevelt Field and a slight rain was falling. Weather reports which reached the field around 2 a.m. indicated that the fog was lifting along the coast, although the rain had left the field in a muddy condition. A great crowd had gathered, but this had thinned out, because of the rain. However, five hundred people waited patiently in the hope of seeing the beginning of the historic flight

At 2 a.m. Captain Lindbergh arrived at the field. The rain had stopped and he ordered the plane brought from the hangar, where mechanics had been working on it. It was placed on a truck and taken across the field to the runway. The gasoline tanks were filled and final preparations made. Captain Lindbergh donned his fur-lined flying suit and with helmet shoved back and goggles on his forehead, climbed into the pilot's seat. The blocks were pulled from beneath the wheels, the plane moved slowly forward, and the flight across the Atlantic had started

Fliers Witness Take-off

Among those who witnessed the take-off, were Bert Acosta, Lieut. G. O. Noville, Comdr. Richard E. Byrd, Clarence Chamberlin, G. L. Stumpt, representative of the St Louis Chamber of Commerce, B. F. Mahoney, president of the Ryan Air Lines and Raymond and Jean Orteig, sons of the donor of the $25,000 prize.

"The Spirit of St Louis", the monoplane in which Captain Lindbergh made the flight, was built at the factory of the Ryan Air Lines, Inc., San Diego, Cal. It has a wing span of 46 ft., gross weight of 5,000 lb., and a high speed of 135 m.p.h. It is powered with a Wright Whirlwind, 225 hp, air-cooled engine. The fuel tanks hold 451 gal of gasoline. The plane carried on the flight two canteens full of water, five sandwiches and emergency Army fare for several days.

THE TAKE OFF. Captain Lindbergh's Ryan monoplane taking off on the Atlantic Flight.

The instrument board was equipped with Tachometer, Earth inductor compass (Pioneer); Bank and turn indicator, Inclinometer and bank indicator, Oil thermometer, Fuel pressure gauge; Carburetor adjustment; Magneto switch, Oil pressure gauge; Reflector for periscope; Instrument lights (four); Clock, Primer; Air speed indicator; Gasoline guage, Altimeter.

Log of Flight

The entire country waited hour by hour for news of Captain Lindbergh's progress. At 7.15 a.m., May 20, word was broadcast that he had passed St. John's, N. F., and was headed over the Atlantic. During the forenoon of May 21, various reports were received that he had been sighted over several places in Ireland. The flying log of the flight, in New York daylight saving time, is as follows:

Friday, May 20

7 52 a. m.	Left New York for Paris
9 05 a. m.	Sighted over East Greenwich, R. I.
9 40 a. m.	Sighted over Halifax, Mass.
12 25 p. m.	Reported over Metaghan, N. S.
1 05 p. m.	Reported over Springfield, N. S.
3 05 p. m.	Passed over Mulgrave, N. S., and Straits of Canso for Cape Breton
5 00 p. m.	Cleared Nova Scotia at Main-a-Dieu
7 15 p. m.	Passed St. John's, N. F., and headed over Atlantic
	Saturday, May 21
8 30 a. m.	Independent Wireless gave out report that a vessel had seen Liedbergh 200 miles off Irish Coast (report doubtful)
8 10 a. m.	Cape Race, N. F., received wireless from Dutch ship that Lindbergh was 500 miles off Irish Coast
8 50 a. m.	London Press Association dispatch said Lindbergh had been sighted 100 miles off Ireland.
10 00 a. m.	Radio Corporation said its Paris office reported plane over Valencia. Clifden received a wireless message that Lindbergh had passed over Valencia
12 30 p. m.	Belfast, Ireland, reported Lindbergh over Dingle Ireland.
2 00 p. m.	Valencia, Ireland government wireless said collier Negri had sighted airplane near Dingle
2 18 p. m.	Cork, Ireland, said Civic Guard reported Lindbergh plane passing over Somerwick Harbor, Ireland
3 24 p. m.	French Cable Company said official advices reported Lindbergh over Bayeux, France at 8 p. m., French time
3 30 p. m.	Reported over Cherbourg, France
5 24 p. m.	Landed safely at Le Bourget Field, Paris.

Twenty thousand people were massed on the east side of Le Bourget field, some of them having waited seven hours and more. The giant light on Mount Valerien flashed its guiding rays 300 miles in the air and the lights of the landing field sent their beams over the great course. Two companies of soldiers with fixed bayonets and the Le Bourget field police, reinforced by Paris agents, had held the crowd in order, but with the roar of an engine overhead and the appearance of a gray-white plane in the sky, it was impossible to restrain the multitude, and thousands of men and women rushed through the police lines toward the pilot and his plane. It is said that the enthusiasm of the populace exceeded that which engulfed Paris Armistice Day, November 11, 1918. Thirty thousand people had gathered at the Place de l'Opera and the Square du Havre, near St. Lazare station, where illuminated advertising signs flashed bulletins on the progress of the flight. London thrilled to the news of the successful crossing and every American city celebrated in some manner or other the feat of the young pilot.

After a brief and hurried reception, U. S. Ambassador Myron T. Herrick took Captain Lindbergh in his car to the embassy where he could rest undisturbed. In the brief interview that he gave press representatives, he said that he was surprised at the short time it took to cross the Atlantic.

WELL AWAY. Captain Lindbergh well away on the start of his Atlantic Flight

The weather was better than he had anticipated over Nova Scotia and Newfoundland. Once on the open sea, he ran into snow and sleet and had to drive through a thousand miles of it. It was impossible to get under or over it, and therefore it was necessary to go right through it a great part of the time. Sometimes the plane was within ten feet of the water and sometimes 10,000 ft. above it. Captain Lindbergh said he sighted the lights of one ship at night on the ocean. At one time there was considerable sleet and ice on the bow of the plane, but this cleared up.

Tells His Experience

Later in recounting his experience, Captain Lindbergh said that he could not complain of the weather, although it was not what had been predicted. Bad weather began after the plane left Newfoundland and continued until four hours before daybreak. He flew at a height of 10,000 ft until early morning, in order to get over clouds. Early in the afternoon he saw a fleet of fishing boats. On some of them he could discern the figures of men and flew down, almost touching some of the craft. He yelled at the figures "Is this the right road to Ireland", but received no response. An hour later (he places the time shortly after 4 p.m.) he saw land. It was rocky land and he concluded it was Ireland. He flew on over England, across the Channel, and passed a little west of Cherbourg. From Cherbourg he headed for the Seine and followed it upstream.

On May 23, at the Elysee Palace, President Doumergue received Captain Lindbergh and conferred upon him the highest honor that France can bestow—the Cross of the Legion of Honor.

B F Mahoney (right) president of the Ryan Airlines, Inc and George J Stumpf chairman of the committee who financed flight

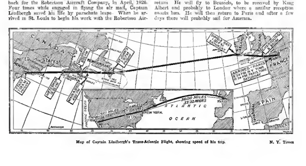
Captain Lindbergh's Career

Captain Lindbergh was born in Detroit, Mich., Feb 2, 1902. He attended school in that city, Little Falls, Minn., and Washington, D. C. After finishing high school, he entered the School of Mechanical Engineering of the University of Wisconsin. He attended this institution for a year and a half and then took a course in aviation at the Lincoln Standard Aircraft Company's school at Lincoln, Neb. He enrolled in the Army school at Kelly Field, Tex., and upon completing the course, was placed in the Air Corps Reserve. In October, 1925, he became associated with the Robertson Aircraft Company, at Lambert-St Louis Field, near St Louis, Mo. He began flying air mail planes to Chicago and back for the Robertson Aircraft Company, in April, 1926. Four times while engaged in flying the air mail, Captain Lindbergh saved his life by parachute leaps. When he arrived in St. Louis to begin his work with the Robertson Aircraft Company, he was a first lieutenant in the Air Corps Reserve. He joined the Missouri National Guard, Thirty-fifth Division, Air Corps, and in December, 1925, was made a captain in the reserve and the National Guard and flight commander of the 110th Observation Squadron.

Visits Madam Nungesser

One of Captain Lindbergh's first acts after official welcomes were over and he had rested from the flight, was to call on Madam Nungesser and express his high regard for the courage and achievements of her son, Captain Nungesser, and the hope that he would yet be found with Captain Coli.

Captain Lindbergh has not yet set a definite date for his return. He will fly to Brussels, to be received by King Albert and probably to London where a similar reception awaits him. He will then return to Paris and after a few days there will probably sail for America.



Map of Captain Lindbergh's Trans-Atlantic Flight, showing speed of his trip. N. Y. Times

Recent American and World Air Records

The National Aeronautic Association has received notice from the Federation Aeronautique Internationale that new World records for airplanes, established in accordance with F.A.I. regulations, have been recognized by that body, viz:

CLASS C (AIRPLANES)
Carrying a Pay Load of 500 kg (1102 31 lb.)

DURATION (Germany)
M. K. Schnaebele and Fritz Loose, Junkers W-33, Junkers L-5 engine, 320 hp., at Dessau, March 21-22, 1927 — 22 hr 11 min 35 sec.
Former Record
Duration (Germany)
M. K. Schnabele, Junkers W-33, Junkers L-5 engine, 320 hp., at Dessau, March 19 1927 — 15 hr 57 min. 39 sec.

DISTANCE (Germany)
M. K. Schnabele and Fritz Loose, Junkers W-33, Junkers L-5 engine, 320 hp., at Dessau, March 21-22 1927 — 2739 999 km 1696 81 miles
Former Record
Distance (Switzerland)
W. Mittelholzer and G. Zinsmaier, Merkur-Dornier, 6 B.M.W., 480 hp. ea., at Dubendorf, June 24, 1926 — 2301 km. 1429 7 miles

CLASS C² (SEAPLANES)
Without Pay Load

ALTITUDE (France)
Lt. Volasseau Demougeot Loire Gourdou Lesseurre 32C 1, Jupiter Gnome 520 hp. at Sartrouville, March 28 1927 — 9290 meters 30 479 ft.
Former Record
Altitude (France)
Sadi Lecointe, Nieuport-Delage Hispano Suiza, 300 hp., at Meulan, March 11, 1924 — 8980 meters 29,462 ft.

CLASS C² (SEAPLANES)
Carrying a Pay Load of 500 kg

DURATION (Germany)
Fritz Loose, Junkers W-33 Junkers L V 320 hp at Aken S-Elbe, March 29, 1927 — 14 hr 9 min 2 sec.
Former Record:
Duration (United States)
Lieut H E Holland, U.S.N., F-5-L flying boat 2 Liberty 400 hp. ea., San Diego Cal. June 9, 1926 — 7 hr 35 min 54 sec.

DISTANCE (Germany)
Fritz Loose Junkers W-33, Junkers L V 320 hp. at Aken S-Elbe March 28 1927 — 1702 08 km 1057 8 miles
Former Record
Distance (Italy)
M Alessandro Passaleva, Savoia Marchetti S-55 2 Isotta Fraschini 500 hp ea., at Lac Majeur Oct 19 1926 — 930 km 580 8 miles

CLASS C (AIRPLANES)
Carrying a Pay Load of 2000 Kg (4409 24 lb.)

DURATION (Germany)
Waldemar Roder Junkers G-24 3 Junkers L-11 250 hp ea., at Dessau, April 1, 1927 — 7 hr 63 min 46 sec
Former Record
Duration (Germany)
M. Steindorf Rohrbach-Roland Type D-990 3 B.M.W Type IV engines 240 hp ea. at Staaken Feb 4 1927 — 4 hr 17 min. 48 sec.

DISTANCE (Germany)
Waldemar Roder, Junkers G-24, 3 Junkers L-11, 250 hp. ea. at Dessau, April 1, 1927 — 1019 180 km 630 02 miles
Former Record
Distance (Germany)
M Steindorf Rohrbach-Roland Type D 990 3 B M W Type IV engines, 240 hp. ea., at Staaken, Feb 4 1927 — 800 km 372 8 miles

SPEED FOR 1000 KM (Germany)
Waldemar Roder Junkers G-24 3 Junkers L-11, 250 hp ea., at Dessau, April 1 1927 — 137 941 km p h 85 711 m p.h
Former Record None

CLASS C (AIRPLANES)
Carrying a Pay Load of 1000 kg (2204 62 lb.)

DURATION (Germany)
Fritz Horn, Junkers G 24 3 Junkers L-11, 230 hp. ea. at Dessau April 4, 1927 — 14 hr 23 min 45 sec.
Former Record
Duration (Switzerland)
W Mittelholzer and G Zinsmaier Merkur-Dornier, 6 B M W 480 hp ea. at Dubendorf, June 26, 1926 — 10 hr 9 min 0 9 sec.

DISTANCE (Germany)
Fritz Horn, Junkers G-24 3 Junkers L-11, 230 hp. ea., at Dessau, April 4, 1927 — 2028 33 km. 1258 11 miles
Former Record
Distance (Switzerland)
W. Mittelholzer and G Zinsmaier, Merkur-Dornier, 6 B.M.W., 480 hp. ea., at Dubendorf, June 26, 1926 — 1400 km. 869 9 miles

SPEED FOR 2000 KM (Germany)
Fritz Horn, Junkers G-24, 3 Junkers L-11, 230 hp. ea., at Dessau, April 4, 1927 — 139 579 km p.h. 86 73 m p.h.
Former Record None.

American Records

New American Records in Class A (Spherical Balloons), Class C (Airplanes), and Class C² (Seaplanes), have been recognized by the Contest Committee of the National Aeronautic Association, as follows.

Those records marked with an asterisk (*) exceed the existing World record for the category, and homologation by the Federation Aeronautique Internationale has been requested.

CLASS A—Spherical Balloons
Grand "Free for All" Record

ALTITUDE:
Capt Hawthorne C. Gray, at Scott Field Belleville, Illinois, March 9, 1927 — 8690 meters 28 510 ft.
Former Record
C B Harmon, at St. Louis, Mo., Oct. 4, 1909 — 4,879 9 meters 15,997 ft.

6TH CATEGORY
Volume 2201—3000 cu. meters

ALTITUDE *
Capt Hawthorne C Gray, at Scott Field, Belleville, Illinois March 9, 1927 — 8690 meters 28,510 ft.
Former Record None.

In accordance with Article III of the F.A.I Regulations, "A Record made by an aircraft of Class A (Spherical Balloons) shall be broken when a balloon belonging to the same or to a lower category shall have made a better performance". The following records are recognized:

CLASS A—Spherical Balloons
7TH CATEGORY
Volume 3001—4000 cu meters

ALTITUDE *
Capt Hawthorne C. Gray, at Scott Field, Belleville, Illinois, March 9, 1927 — 8690 meters 28,510 ft.
Former Record None.

CLASS C (AIRPLANES)
Without Pay Load

DURATION *
Clarence D Chamberlin and Bertrand B. Acosta, Bellanca Monoplane Wright J 5, 200 hp., at Roosevelt Field, Long Island, New York, April 12-13-14 1927 — 51 hr. 11 min 25 sec.
Former Record (WORLD)
Duration (France)
Drouhin and Landry Farman biplane, Farman 450 hp., at Etampes-Chartres, Aug. 7-8-9, 1925 — 45 hr 11 min 59 sec

CLASS C²—(SEAPLANES)
Carrying a Pay Load of 500 kg (1102 3 lb.)

ALTITUDE: *
Lieut George R Henderson U S N., Vought Corsair, Pratt & Whitney Wasp. 420 hp., at Washington, D C., April 14 1927 — 6760 meters 22,178 ft
Former Record (WORLD)
Altitude (Germany)
Capt E. L. Tornberg Heinkel seaplane, Napier Lion 450 hp., at Warnemund Nov 19 1926 — 5751 meters 18 868 ft

Panama Regulates Aviation

A decree regulating aviation in Panama has been promulgated by the Government. This requires that all aircraft in the Republic must be registered between Jan 1 and 15 of each year and must pay an annual registry tax of $75. Each craft must carry its registry number in a conspicuous place in arabic numerals. The decree also states that no private airplanes may fly over the territory of the Republic without permission from the Government, which shall be extended in accordance with the law and with international treaties.

The new Glenn L. Martin Modal 74 Navy three purpose plane with Pratt & Whitney Hornet engine.

A New Kind of Three-Purpose Plane

Glenn L. Martin Model 74 Three-Purpose Navy Plane Pioneers High-Power Air-Cooled Engine Class. Pratt & Whitney Hornet Engine Installed and Outstanding Performance is Attained.

THE THREE-PURPOSE plane presents one of the most difficult phases of the Navy's aircraft program. The weight of bombs, torpedo, guns, crew, fuel and other equipment, in conjunction with the weight of gear required for arresting, catapulting, and inter-changeable land and water landing, requires an airplane of the larger class to fulfill the three-purpose mission. It is readily understood how heavily size, weight and complication of structure militate against the operation of this type of airplane aboard aircraft carriers, where landing, handling, and stowage space and facilities are at a premium.

It has been demonstrated that a three-purpose plane, with water-cooled power plant must inevitably weigh nearly 10,000 lb. when carrying the desired useful load. Studies of this type of plane made some years ago, indicated that a much better showing could be made with air-cooled power. At that time, however, the prospect of producing a successful air-cooled engine of required output was rather dark and unpromising.

On the other hand the Bureau of Aeronautics, following its progressive policy for air-cooled engines, held that "there was manifestly a demand for another (air-cooled) engine for the heavier types of aircraft"—and proceeded, with the effective efforts of engine manufacturers, to develop engines of this size of the radial air-cooled type.

This put the problem squarely up to the airplane designer. The results were startling. The single-engine air-cooled design, with the same military load was well over a ton lighter than the water cooled type, and preliminary flight trials made in April at the Glenn L. Martin Company plant in Cleveland indicated that the performance has been improved in all respects by a generous margin, although the air-cooled power output is 200 hp. less than the water-cooled. This appears, if one may quote a recent article on the subject by Comdr. E. E. Wilson, head of the Design Section of the Bureau of Aeronautics, "to make all the difference in the World between a successful carrier bomber, and a very difficult one."

The Hon. Edward P. Warner, Asst. Sec. of the Navy for Aeronautics (left) and Glenn L. Martin photographed at the time of the testing of the new Martin air-cooled three-purpose plane.

Individual improvements have been incorporated in various airplanes from time to time with good results, but it remained for the high-powered air-cooled engine to supply the nucleus about which all important improvements could be consolidated in one airplane. Lighter powerplant, improved aluminum alloy construction, a new airfoil, and greatly improved aerodynamic arrangement have been effectively combined to produce a new kind of three-purpose plane.

This plane is the first complete product of a program of research and development which was begun by the Martin organization in the fall of 1925. The complete story of the determination to begin with fundamentals and sweep away all obsolete construction has many interesting and unusual angles. Only a brief description of the more prominent features pertaining to this plane may be given at the present time.

Fuselage Construction

The fuselage frame has an entirely new type of aluminum alloy construction, which slightly improves upon the weight strength efficiency of tubing, but greatly surpasses the latter for simplicity of attachment and replacement of fittings, struts, brackets, and other parts. The fittings and attaching parts have been so simplified that the fuselage frame is 145 lb. lighter than the same arrangement with steel tubing. A unique feature of this construction is the fact that it is based on a structural shape which is purposely designed to take protective anti-corrosion coatings. The Martin Company's sea-side immersion tests, which have now run over 4,000 hourly immersions clearly indicate that the shape of material and methods of making joints are important factors in the life of protective coatings.

The Navy's researches on airfoils which produced the group of high biplane coefficient airfoils (N-9 to N-18) is the source from which a new wing section (Martin No. 24) was developed for this three purpose type. Tests made at Göttingen on this wing section indicate unusually favorable biplane coefficients at the landing speeds.

The wing beams are of heavy gauge aluminum alloy trussed channel construction, with simplified attachments for all fittings, struts and brackets. From the nature of the design all joints are inherently drained and ventilated. The ribs are aluminum alloy channel, and the interplane struts are streamline steel tubes. The wing structure shows a slight saving in weight over the corresponding wood construction.

All fittings throughout the plane are made of best quality chrome molybdenum steel, resulting in an appreciable weight saving over the old-type carbon steels.

The simplified mechanism for dual wheel and rudder control in the front cockpit can be readily dis-engaged to leave the entire cockpit clear for bombing operations.

Simplicity of Control

Special attention has been paid to lateral control at all speeds. The plane follows the control wheel without any lag. During flight trials the plane was flown at a low speed of 36 m.p.h. (with light load) with accurate and positive aileron control. This speed is about 8 m.p.h. below stalling speed. This result is due to special design ailerons, of high roll-yaw ratio, and is especially important for landing and take-off on the carrier.

The arrangement of crew and equipment has been greatly improved over older types, affording maximum visibility for deck loadings, and for formation flying. All bombing vision angles have been increased.

A close up view of the split axle undercarriage of the Martin Type 74 Navy three purpose plane.

For the first time the arrangement for cranking a large engine is entirely inside the airplane. The cranking-shaft extends back into the forward cockpit so that the engine can be started at sea without getting out of the cockpit. Booster, primer and switches are provided convenient to the crank handle. This arrangement eliminates the weight and drag of engine-cranking platforms, step and shaft stubs.

The engine accessories are all enclosed in a special sheet metal cowling. This housing is readily removed from within the forward cockpit giving complete access to magnetos, carbureter, pumps and starter, either on the ground, or if need be, on the open water in rough weather. The magneto-compartment is specially cooled by the air under suction.

The engine mounting is of chrome-molybdenum steel, of simple design, weighing 29 lb.

The airplane is fitted with inter-changeable landtype and twin float gear. An improved type of shock absorbing and anti-rebound unit is incorporated in the landtype gear, capable of absorbing shock loads up to several times the weight of the plane, without perceptible re-bound. This unit is also in full effect when taxiing. Electric tracings on

A three-quarter rear view of the new Martin three-purpose plane with Pratt & Whitney Hornet air cooled engine.

night photographs show that the path of the fuselage is practically horizontal when taxiing, regardless of the irregularities of the ground surface.

Stations are provided for pilot, assistant pilot, bomber, gunner and radio operator.

Particular care has been taken throughout to make the plane a perfected mechanism for accomplishing its mission, without inherent hazards of its own, thus leaving the mental attitude of its crew undisturbed.

Specifications

The specifications for this plane when equipped as a landplane are:—

Span	83 ft
Length	57 ft.
Height	13 ft. 5 in.
Gross weight	7000 lb
Light weight	3500 lb
Useful load	3500 lb
Maximum speed level	120 m.p.h.
Service ceiling	12,500 ft

Campbell Nibbling Machine

The Campbell nibbling machine, manufactured by Andrew C. Campbell, Inc., Bridgeport, Conn., combines a new process by which a narrow path is cut or nibbled through sheet metal at a rate of twenty or thirty inches a minute. It enables the operator to cut any external or internal design with the greatest of ease and rapidity, without distortion of the metal and with less strain than most cutting processes. This machine cuts clean and close to the line. Very little grinding or filing is necessary.

This machine comes in five sizes. One of these machines was recently purchased by the Edo Aircraft Corp., and installed in its plant at College Point, L. I.

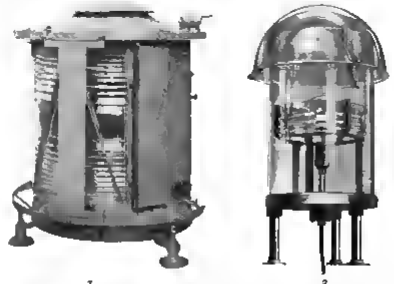
B. B. T. Products Light Europe's Airways

Some indication of European activity in the lighting of airports for night flying is given by a recent report of the B.B.T. Corporation of America covering installations of B. B. T. equipment in Europe. It appears that more progress has been made toward the establishment of night air routes than is generally realized in the United States, perhaps because the night equipped airways which now cover Europe are not extensively used commercially as are the air mail routes here.

Several very interesting facts are brought out in the report with reference to the activities of the various nations and the different opinions with regard to various types of lighting equipment. It is most interesting to note the comparatively large amount of equipment purchased by a number of smaller European powers where it is not generally known that active night flying operations are carried on. For example, Esthonia has three completely equipped landing fields with the most expensive type of landing footlights and other equipment. Holland also has three completely equipped fields and in addition a number of navigation lights or beacons.

Czechoslovakia has copied the lighting installation of Le-Bourget, one of the largest and most completely equipped airports in the World, in installing lighting equipment on their principal field at Kbely. Jugo Slovakia has four airports equipped with the most up to date and expensive type of equipment, the same as used at Croydon, LeBourget, and in the United States at such airports such as Clevaland, Chicago and Omaha. Turkey has three airports completely equipped for night flying, using the Croydon and LeBourget B.B.T. system.

Switzerland, Belgium and the Argentine also appear as large purchasers of B.B.T. night flying illuminating equipment. Little information is at hand with reference to Russia, with the exception that the Soviet Government has expressed particular interest in equipment suitable for military purposes.



B. B. T. LIGHTS

1.—B. B. T. Air Mail Type Landing Floodlight of the latest type showing the installation of blind or shutter that may be adjusted to any position in front of the 180° lens. This provides a dark area in which a plane may land and taxi directly toward the light.

2.—New B. B. T. Flashing Beacon the horizontal beam of which is completely visible over 360° and the direct light above to the zenith. It has a range up to 25 miles and produces a flash of distinctive characteristics at more frequent intervals and with a longer period of visibility than the present types of beacons now in use in this country.

Contrary to the current policy and practice in the United States, the European airways are universally illuminated by the flashing beacon type of aerial lighthouse. The beacons are capable of flashing distinctive signals and are visible throughout 360 deg. on the horizon and upward to the zenith. This is in contrast to the rotating type of beacon used in this country which projects a beam of high intensity but with a very limited range of visibility and a long lapse intervening between flashes.

The airports in England and on the Continent are likewise marked with the same type of flashing beacon, using optics similar in some ways to those used in marine lighthouses. There are many types of flashing beacons ranging in size from the small lens unit with a 1000 watt lamp as a source to the largest unit, that at Dijon, France, which develops one billion candlepower, and employs eight 150 ampere arc mechanisms installed behind eight lens panels.

While night flying conditions in Europe are naturally different than those prevailing here, it is, nevertheless, reasonable to believe that some valuable information may be gained by studying the methods in use there. It is interesting to note that every civilian airport in France is equipped with a B.B.T. flashing beacon and likewise these beacons are universally used by the French Army.

Air Taxi Line in Detroit

A new air taxi line has been opened in Detroit, with Stinson cabin planes as equipment. As a subsidiary of the Wayco Oil Corporation of which Edward F. Schlee is president, A. G. Schlee, vice-president, E. H. Schlee, vice-president, and Dewey Schlee, treasurer, the line will operate out of Detroit for any point in the United States, Canada or Mexico.

Stinson-Detroiters are completely enclosed and heated for Winter flying, are weather-proof and sound-proof and will attain a top speed of 125 m.p.h. and a cruising speed of 105 m.p.h. The cabins are comfortably and beautifully upholstered in chrome leather with five wicker chairs, well cushioned. There is room in the cabin for passengers' baggage as there is also in a special compartment in the fuselage. The planes are spin-proof and will not go off on a wing, while controls can be abandoned in a stall with the engine off without endangering the passengers or pilot. The company intends to start its taxi service deLuxe with two Stinsons and increase this equipment as the line grows in popularity.

Metal Propeller Development

Extensive Test Work Responsible for Present Efficiency of Metal Propellers for Aircraft Use

By E. G. McCAULEY

U. S. Army Air Corps, Engineering Division, McCook Field

IN WRITING on the subject of Metal Propellers, only the latest types as used and developed by the U. S. Army Air Corps Engineering Division will be described in this article. While no attempt is being made to criticise other existing types of metal propellers, it is believed that this is the first publication on the U. S. Army Air Corps Engineering Division developments of various types of successful metal propellers.

Acknowledgment is here made of the Reed typs of metal propeller construction, and it is believed that this form of propeller as now used in general service, is well enough to need no further description or comment, as the other types now in use by the Army and Navy are the exclusive designs of these divisions of the U. S. Air Corps. It is the intention of this article to give a clear concise description of these designs, materials and methods, for the benefit of all concerned.

Fig. 2.

The Detachable Blade

It seems well to make mention here that the detachable blade idea such as is now extensively used, was first incorporated in a solid forged steel blade propeller, designed by the U. S. Army Air Corps Engineering Division in the early part of 1918. Likewise all the adjustable and reversible propellers, from the earliest until the most recent developments of these types, were designed and built with detachable blades, while in these latter types the blades were capable of being rotated on their axis while in operation, in order to adjust or change the pitch of the propeller in flight.

It being well known that detachable blades had been in universal use many years ago, on marine propellers for water craft, particularly on such types adapted for feathering the blades, no originality is claimed in choosing this type of blade, other than that it is believed these were possibly the first propellers to be built in the United States for an airplane incorporating this idea. Previously to this, practically all propellers, at least those that were in use on planes, were constructed of wood or steel in a solid one-piece blade form.

The detachable blade as now used in the construction of metal propellers has many advantages over what might be termed the one-piece or fixed blade type, which may be summarized as follows:

1. To allow changing the regularity of the blades and likewise the adjustment of pitch.
2. To provide the interchangeability, suitable for two, three or four blade propellers.
3. Flexibility of design is better accomplished with detachable blades.
4. Adaptability for a detachable blade propeller to fit different design of planes is greater than a one piece propeller.
5. Manufacturing cost per blade is less.
6. Operating costs are less, due to replacements only necessary on a single blade instead of a whole propeller.
7. Stock requirements may be kept up with less number of blades at reduced costs and occupying less storage space.
8. Standardization and production methods can be better materialized in a single detachable blade.

The foregoing items are apparently outstanding facts in favor of detachable blades for airplanes over the one-piece or fixed blade propellers.

The use of aluminum alloy in the manufacture of metal propellers has been an outstanding achievement, which has practically eliminated the use of wood propellers, especially on production or quantity orders, besides offering many advantages over wood which may likewise be briefly summarized:

1. Greater efficiencies are obtained from metal blades having thin sections over the thick wood propellers, due to less drag on the sections.
2. Less consumption of fuel for traveling a given distance, due to an increase in speed by the use of metal blades.
3. The power absorbed by a metal propeller in useful work is greater due to the ratio of thrust delivered by the propeller to the torque delivered by the engine being greater.
4. Metal propellers may be operated in any kind of climate, being unaffected by moisture which is a great drawback to wood propellers by causing them to warp out of shape and become useless, due to either absorbing too great amount of moisture or else becoming dried out in certain climates.
5. Metal propellers are considerably more durable than wood, due to being less affected by rain, dust and small particles of grit that are encountered when flying at low altitudes.
6. Storage facilities are greatly reduced and less expensive to maintain for metal propellers, as wood propellers require a very elaborate conditioning room to prevent them from opening up and twisting out of shape.

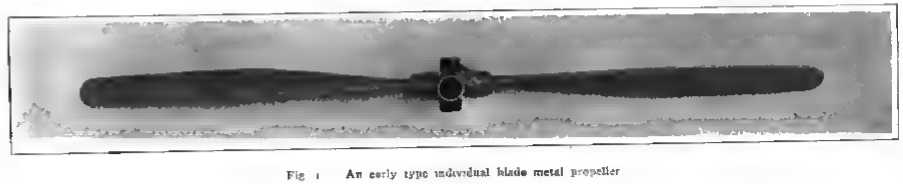


Fig. 1. An early type individual blade metal propeller

7 The use of forging dies to form the blades offers a practical manufacturing method for fabrication of metal propellers. Quantity production can be greatly increased over the wood propeller methods.
8 Metal propellers, when properly designed, due to their thin sections and greater flexibility tend to cause less vibration when running at high speeds.
9 Higher tip speeds can be obtained by the use of metal propellers.
10 Aluminum alloy properly heat treated has the required strength and toughness to facilitate making metal propellers of solid construction without excessive weight as compared with wood or steel propellers.
11 Aluminum alloy propellers are approximately 15 percent heavier than wood propellers in sizes up to 11 ft. Above this, they average about the same. 18 ft. diameter, being the largest size thus made to date.

While various attempts had formerly been made to produce a metal propeller for an airplane out of steel or other metal by many different designs and methods, nearly all these

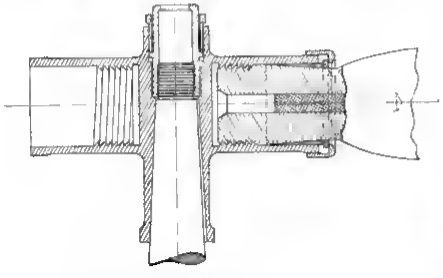


Fig. 3.
A sectional view of a hub with split tapered sleeve

former propellers either failed under test or else were too heavy for practical purposes. The use of aluminum alloy seems to have bridged a large gap in metal propeller construction and brought in to practical use a suitable metal having the proper qualities for the existing conditions now required as to strength, weight and method of manufacture, thus opening up a broad field for further development of the metal propeller.

Composition of Aluminum Alloy

For the benefit of those who are not familiar with the chemical analysis and the forging characteristics of aluminum alloy as used for propellers, a brief description will be given for enlightenment on this particular material.

This material may be obtained in a variety of sizes, likewise in various forms and shapes, being commercially procurable in bars, tubes and sheets. For forging purposes it is usually obtained in the billet form much in the same manner as steel, which is then worked in a hot condition under a hammer at rather low temperatures.

The heating range is considerably lower than that used for steel, being mostly used from 800 deg. to 850 deg. F, which is a satisfactory forging temperature. If the forging heat is raised above a critical temperature the metal loses its strength and will not congeal together. Also, if worked too cold it has a tendency to fracture. A very necessary requirement is to have the metal heated uniformly, beyond which the amount of forging that can be safely handled at each heat is a matter of experience. The metal will flow easily in forging dies when subject to very hard hammering. It is also desirable to have plenty of power applied on the metal, as an inadequate blow will not cause the metal to flow properly and is likely to cause fractures and break up.

The chemical analysis of this material varies according to the requirements, but the average consists of:—Copper 3.0 to 5.0%; Magnesium .3 to 5%; Manganese .4 to 1.0%; Balance in aluminum plus impurities. The physical properties are: Specific gravity 2.85; Weight per cu. in. 101 to 103 lb. Melting point 1004 deg. F.

After forging, this material is capable of being heat treated, thus increasing its strength to that of mild steel. The heating process consists of heating to from 925 deg. F. to 950 deg. F. and quenching in water. Immediately after quenching the material is still soft and ductile, as the actual toughening does not start until about an hour later and then continues for three to four weeks. An aging process is sometimes used to facilitate quicker toughening. This usually consists of quenching in boiling water and leaving the parts in this bath for two hours or more. When the parts are removed, the aging is complete.

The physical properties thus obtained average as follows: Tensile strength 55,000 to 60,000 lbs. per sq. in.; Yield point 35,000 to 45,000 lbs. per sq. in.; Elongation (2 in. 2 in.) 15 to 20%; Scleroscope Hardness 20 to 25; Brinnal Hardness 80 to 100.

Aluminum alloy for propellers was first adopted by the U. S. Army Air Corps Engineering Division into detachable blades of their own design in 1922, after tests had been made prior to this on propellers made of aluminum alloy designed and built by Dr. S. A. Reed of New York.

Early Types of Propellers

The earlier propellers experimented with, consisted mainly of detachable blade screw threaded into a steel hub, in which the threaded portion of the blades came very close to the outer end of the hub. Due to the blades not being rigidly held in the hub other than by a close fit on the threads and a small round turned portion to form a bearing, the excessive vibration of the engine caused the blades to break off at the end of the hub as shown in Fig. 2.

In this form of construction a whipping action was set up between the blade and hub, likewise producing an excessive vibration between these parts, thus causing the blades to snap off at the root of the threads, which generally occured at the thread nearest the end of the hub. While extreme care had been taken to prevent but slight clearance between the blade shanks and hub, which was practically negligent after being screwed into place, nevertheless these precautions were not sufficient to prevent the rupture of the blades and further methods had to be considered to overcome this weak structural feature.

After repeated attempts to prevent the blades from breaking off at the end entering the hub a design was worked out by the writer incorporating a split tapered sleeve inserted between the shank of the blade and the hub which was forced and held into place by a collar threaded on the hub. The extreme end of the blade was threaded for a small portion of its shank with a large buttress form of thread, which engaged a like thread on the inner diameter of the hub. This form of thread was found to be best adapted to take the centrifugal force of the blades, likewise relieving any outward stress imposed on the collars holding the split tapered sleeve. This allowed the collars to hold only the sleeves in position and form a solid bearing connection between the blade shank and hub as shown in Fig. 3.

This shows the preferred embodiment, while a slight modification was made by making the blade shank round and tapering the outer portion of the hub. It will be noted that the collars have practically nothing to do in regard to retaining the blades in the hub against the centrifugal force as these are securely held by the buttress thread.

Fig. 4.
Various types of tapered sleeves used

This type of hub construction proved very satisfactory in preventing breaking off of the blades caused from the excessive vibration and whipping action in the hub by eliminating all looseness between these two parts at the point of attachment, which practically made the blades and hub like an integral unit.

A similar form of tapered sleeve construction for holding a wood blade into a hub, had been tried out many years prior to the development of an adjustable pitch propeller and the rigidness found in this construction was considered very adaptable to the present design of aluminum alloy detachable blade.

In the fabrication of this type propeller a very important requisite after the blades are assembled in the hub is that the propeller as a whole be properly balanced. This was a vary easy operation with wood propellers by simply scraping off a little on one blade or else adding an additional coat of varnish or paint. On metal blades the operation of final balancing becomes more difficult, metal being much tougher than wood. Furthermore, the specific gravity of the two materials varying greatly, thereby necessitating a greater proportion of metal to be removed, which filing or grinding off is a slow procedure. To facilitate the balancing of detachable blades, a method was devised whereby the shanks of each blade were drilled out and, after a trial, balance was made in a dummy hub, by balancing one blade against a standard blade, a portion of load being poured into the drilled end of the blade shank to provide the desired balance. This gave fairly good results for horizontal balance, but when the propeller was suspended vertically, any lack of balance

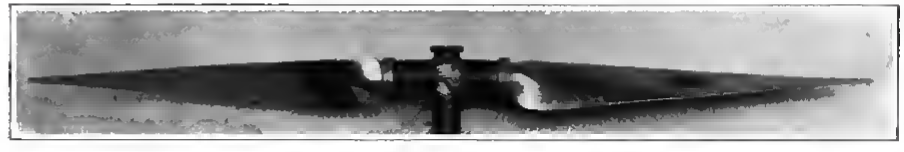


Fig. 5. Solder at the middle of hub used for balancing.

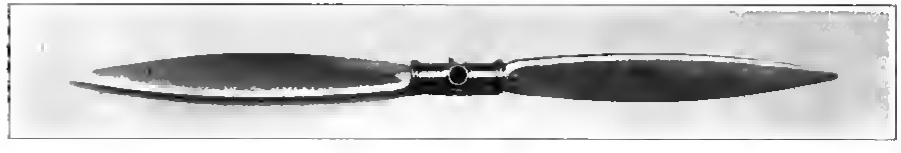


Fig. 6. A 400 hp. propeller tested to 1400 hp.

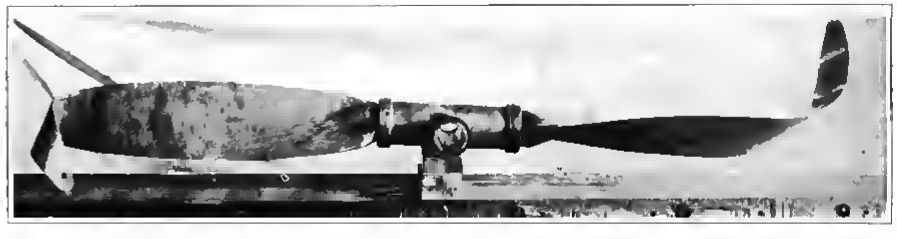


Fig. 7. Solid hub type removed from plane which made bad landing. Blades curved up at end instead of breaking off.

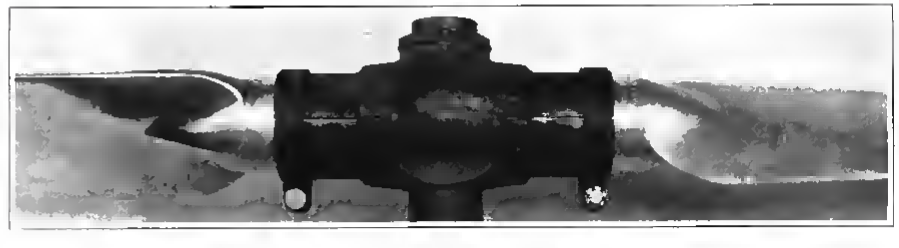


Fig. 8. Split-hub type propeller.

occurring had to be compensated by adding solder on the hub This was very unsightly at times The collars holding the tapered sleeves also offered objections to balancing since when a propeller was properly balanced for a given pitch setting, should it become necessary to change this pitch, the collars would have to be loosened In tightening them again it might result that the position of the collar on the hub is varied, thus effecting the horizontal balance.

In adopting aluminum alloy blades for airplane propellers, like all other propellers of new design and construction, it becomes necessary that they withstand very rigid testing before being placed on a plane The customary method is to place the propeller on a whirling test rig and revolve same by electric motors, in which the thrust created by the propeller and the power to operate same is measured For wood propellers the usual overload applied for the whirling test is about 50 percent greater than its rated load Thus a propeller designed to absorb 400 hp would be tested to withstand 60 hp for 10 hr. which is considered a safe working load for flying conditions.

After this whirling test, an engine test on the ground is given under full throttle for approximately 20 hr., at its actual horse power rating Quite frequently the results of this test under the flying conditions will show very destructive results to a propeller due to the excessive vibration and inertia forces set up by the engine Many propellers that have safely withstood a test on the whirling stand under a big overload capacity have been broken to pieces when operated on an engine for a short length of time, which tends to prove the necessity of carefully testing a propeller under as many conditions as possible

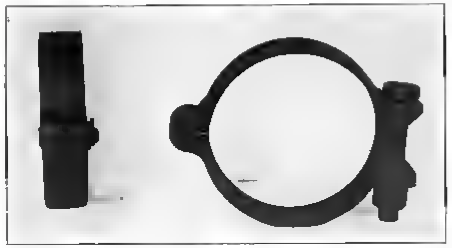


Fig 10. Clamping rings as used for vertical balance.

In testing an aluminum alloy propeller with detachable blades designed by the U. S. Air Corps Engineering Division for 400 hp, as above described, an input of 1400 hp. was applied to this type without failure. This is a most convincing fact in proving the durability and strength qualities involved in this type of propeller It represents an overload of 250 per cent. When it is considered that the average wood propeller bursts to pieces under 80 per cent overloading a further realization of the remarkable qualities the metal propeller offers is obtained.

Referring back to the advantages outlined for detachable blades regarding the adjustment of pitch of the blades, it will be acknowledged that after a propeller is carefully designed, there is still the possibility of not meeting the exact requirements for the plane This becomes a simple matter with detachable blades by making a slight adjustment of the angularity of the blades as desired, which flexibility of design would enable a propeller to be applied to a number of different planes, where the characteristics of the planes vary

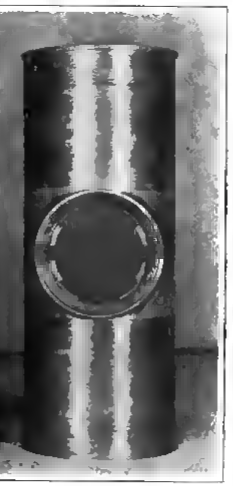


Fig 9 Inside and outside views of hub forgings.

The foregoing description has been devoted to what may be termed a solid hub with detachable blades which constitutes a hub forged solid and machined out to allow fitting in the blades. The hub extension is taper bored to suit the engine shaft The blades are screw threaded to engage a thread in the hub and held rigidly in the hub socket by a tapered sleeve and collar.

This type of propeller was the first of the U. S. Air Corps Engineering Division designs to be put in actual service at McCook Field. These propellers after three years service testing have shown many remarkable achievements, including greater efficiency, faster speed, better adaptability and more economical operation, thus practically superseding wood propellers and bringing about a radical change in future development.

Fig 6 shows one of the solid hub type removed from a plane, which in making a bad landing, nosed over into the ground.

Instead of the propeller blades cracking up and breaking off as customary to the wood propeller, these blades curved up at the ends Several similar cases have happened and the blades are merely straightened out and the propeller put back in service.

In order to keep pace with the rapid strides made with aluminum alloy propellers the writer has devoted considerable attention to the practical and productive side of the problem in order to provide a design that will help to cheapen the production cost, thus enabling metal blades to be manufactured

(*Continued on page* 1144)

Fig 11 Split hub type propeller now standard for service use.

The Recent Air Records

Value and Importance of Air-Cooled Engine Development is Reflected in Record Performances

By COMDR E. E. WILSON, U. S. N.

SOME YEARS ago, a statement was made that no great improvement in aircraft performance could be expected unless a new type of engine were invented. It was generally conceded that aeronautical progress must take the form of gradual improvement and refinement of design. No doubt, the persons who reached these conclusions had in mind some novel form of powerplant unknown at the time. Many of them did not realize that such a power plant was in process of development right under their noses Many people today have hardly come to realize that such a powerplant is actually available at the present time The recent air records made by our air-cooled engines have brought us to the realization that we are in the realm of a new form of aeronautics as a result of a new powerplant development

During the past few months five new World airplane and seaplane records have been set up in this country. Four of these were made in Naval aircraft and Commander Wilson points out that in every case the record breaking performances have been set up with air-cooled engined planes. Furthermore, in each of the five cases, standard type aircraft have been employed, as opposed to especially designed machines. "When World records are established by service types, it is a good indication that we are entering into a new era of aeronautics", he concludes.

Of course, we have long realized that air-cooled engines resulted in the saving of the weight of the cooling system and, in the case of airplanes designed about the engine and not just adapted to it, further resulted in a corresponding saving of weight of the structure We have recently had demonstrated conclusively that, even in the pursuit field, our air-cooled engined airplanes are equal in speed to the water cooled engined machines and superior in performance at altitude. It is only when we come to the really big aircraft that we appreciate how revolutionary this powerplant change is.

We have recently had an opportunity to compare, side by side, the Navy's three-purpose single-engined water-cooled bomber and the more recent air cooled bomber In these, the air-cooled powerplant weighs just one-half as much as the water cooled powerplant. The air-cooled machine has approximately twice the service ceiling of the water-cooled plane and approximately fifteen miles higher speed. Manifestly, the new type of powerplant is here A fifty per cent reduction in powerplant weight is striking, to say the least. It is not unnatural, then, that World records should begin to fall.

The first record was that for duration established by Chamberlin and Acosta in the Bellanca Monoplane with the Wright Whirlwind engine. This is the same airplane with which Lieut C. C Champion, U. S. N., won the speed and efficiency events for light commercial airplanes and transports at the Sesqui-Centennial Air Races last fall. During the transport race Lieutenant Champion carried 1,710 lb of contest load which, combined with the weight of the two pilots and 45 gal of fuel brought the useful load of the airplane up to about 2,300 lb The machine took off about like a "DH" and handled beautifully in the air This performance focused attention on the possibility of breaking the World endurance record and accomplishing the New York-to-Paris flight At Lieutenant Champion's suggestion, the Wright Aeronautical Corporation carried out the installation of a large fuel

Wright Apache shipboard fighter powered with Pratt & Whitney Wasp engine in which Lieutenant Champion made Seaplane Altitude Record

tank for this purpose. The breaking of the World's endurance record was the final result of this. The combination of a well designed airplane powered with a modern air-cooled engine, in the hands of skillful pilots, brought this record back to the United States. The striking fact is that the Bellanca was not especially designed for the purpose. Greater duration could have been obtained in a machine especially designed, but the modification of a standard airplane through the installation of suitable tankage produced the result. The basic reason is "high useful load per horsepower."

The same considerations held in the World records established shortly after the Bellanca record by three Navy pilots, Lieutenants George R. Henderson, James D. Barner, and S. W. Callaway, of the Flight Test Section of the Naval Air Station, Anacostia, D.C. The Vought Corsair, in which the records were made, was designed by Chance Vought in collaboration with the Bureau of Aeronautics as a replacement for the UO's on board the light cruisers and battleships of the fleet. It was a straight-forward two-seater observation airplane built about the Pratt & Whitney Wasp engine and incorporating in it all the experiences of several years of fleet operation by its predecessors, Vought UO's. The performance of this airplane in the trials was so striking that it became immediately apparent to the Trial Board that World records could be readily established. Upon completion of the trials, the plane was prepared for this job. The preparation consisted of removing military load and substituting therefor the dead load of 500 kg. No alterations were made in the machine but the propeller was set for best performance in climb. Other than this, the airplane was standard.

Lieutenant Henderson made one or two trial flights to make certain that everything was functioning properly and then took off for the record without any fuss or feathers. The Corsair as a seaplane climbed to an altitude of 22,178 ft. and brought the record back to America. Here again was a fine combination of good design, a rugged powerplant, and skillful piloting.

It may be well to digress for a moment to point out just how fine Vought's design is. At the very moment Lieutenant Henderson was at his 22,178 foot ceiling with the Corsair as a seaplane and a total useful load of over 1,700 lb. one of our most modern single-seaters using the same engine carrying about half the useful load on wheels was unable to reach this ceiling by about 1,000 ft. In other words, the Vought Corsair two-seater excels some of the best single seaters at altitude.

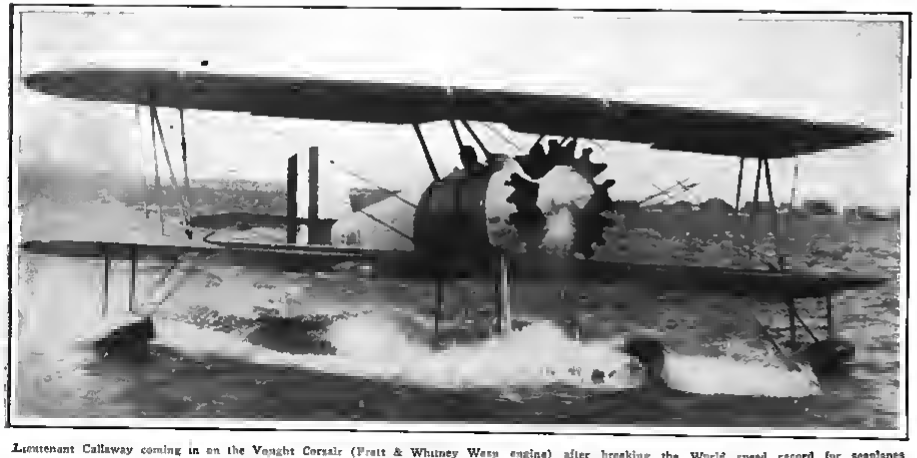
However the Corsair performance is not confined to altitude. The moment the altitude record was over the machine was flown to Hampton Roads and just over the course for the World seaplane record of 100 km. with the same dead load. Lieutenant Callaway, flying the 25-kilometer triangular course, averaged 147.263 m.p.h. It is interesting to compare this seaplane performance with 500 kg. useful load with that of our observation landplanes in the Sesqui-Centennial Races where a best average speed of 141 m.p.h. was made. The Corsair as a seaplane with 500 kg. was six miles faster than the observation landplanes without useful load, at Philadelphia.

With the 100 km. safely stowed away, Lieutenant Barner immediately went out for the 500 km. record, and on April 30, 1927 established a new one of 136.023 m.p.h. in the same airplane.

A 25-kilometer triangular course imposes considerable restrictions on the results because of the large number of turns required. A 50-kilometer course will be established soon and better results can be had. As a matter of interest, the Vought Corsair, since it was presented for trial, has flown well over 100 hr. and yet established these records without any attention whatever to engine or airplane. The engine is one of the first experimental Pratt & Whitney's. The results promise a great deal for the production engines. Another of the earlier experimental engines installed in the Curtiss Hawk has well over 300 hr. of hard flying and is apparently as good as new.

For the past several months, Lieut. C. C. Champion, U. S. N., has been doing some experimental work with the Wright Apache using the National Advisory Committee for Aeronautics' supercharger. This is the same Apache which Lieut. Champion flew in the Free-for-All Pursuit Race at Philadelphia last year when he demonstrated conclusively the performance of air-cooled engines in high speed airplanes by showing a higher speed than any other normal-compression-engined pursuit plane. On May 5, 1927, Lieutenant Champion took off with the Apache on floats and climbed to a new World seaplane altitude record of 33,455 ft. The total time off the ground of this machine was 36 min. and but 25 min. were consumed in climbing to the altitude. This gives a rate of climb of about 1400 ft. per min. The Wright Apache is equipped with the Pratt & Whitney Wasp engine.

To summarize these results, it is apparent at a glance that five World records have returned to the United States in the last few months, that all of these have been obtained with modern air-cooled engines, and that more are in sight. Still more important is the fact that none of the airplanes have been especially designed for the purpose but all have been adapted by making such minor changes as were necessary. When World records are established by service types, it is a good indication that we are entering into a new era in aeronautics.



Lieutenant Callaway coming in on the Vought Corsair (Pratt & Whitney Wasp engine) after breaking the World speed record for seaplanes carrying 500 kg. over a 100 km. course. His speed was 147.263 m.p.h.

Spinning Tests on Observation Planes—McCook Field

THAT THE air is still new territory to be conquered is exemplified by the divergence of fact and theory not infrequently encountered in solving some of its ever ontropping problems. An example of such divergence has recently been brought to light in the tests being conducted to determine the cause of the unsatisfactory characteristics in recovery from spinning of one of the newer types of observation airplanes. The necessity for such investigation was brought to a climax last August when, it will be remembered, Lieutenant Barksdale, in flight testing a new observation plane, met his death when the plane he was flying could not be recovered from a spin. Intensive study of these spins has been in progress ever since by the National Advisory Committee Laboratory at Langley Field, and by the Materiel Division at McCook Field, both in the wind tunnel and in actual flights.

In the studies at McCook Field, two airplanes, an O-1 powered with a Curtiss D-12 engine and an O-2E4 powered with a Liberty "12A" have been used. Models of these planes were employed for the wind tunnel tests. The study, however, of the wind tunnel test results, including calculation of the rates of autorotation, did not explain the behavior of the airplanes tested, since many of the theories existing upon spinning were disproved and there were not a sufficient number of facts upon which to base reliable new data. Hence, resort was made to actual flight testing.

Preliminaries For Tests

In preparation for flight test, the planes were stripped of all unnecessary equipment, carefully weighed to learn the center of balance and equipped with steel tanks set under the fuselage, one behind the rear cockpit, the other forward of the front cockpit. Shot was used in the tanks for load and by varying the relative amount of weight in the front and rear tanks, the center of balance was moved forward or back, as desired. Openings in the bottom of the tanks made it possible to drop the entire ballast if the airplane showed stubbornness about coming out of the spin. This method of testing was originated at the Douglas Company's plant when Lieut. H. A. Sutton and Lieut. Wm. N. Amis went there as Materiel Division Representatives to observe spinning tests of the O-2, and the first tests were conducted by the Douglas Company, where recovery from a Douglas O-2C with greater than normal span could not be effected with the center of gravity to the rear of twenty-four per cent of the chord. When tests were undertaken at McCook Field with a Douglas O-2E4 with wings of normal O-2C span, but without wing tanks, the condition of wing tanks was simulated by the installation of bomb racks and bombs beneath the wings. The bombs, of course, could also be easily released to facilitate recovery from spinning. The spinning tests at the Materiel Division were conducted at an altitude of from 8,000 ft. to 10,000 ft.

Accurate records of the spins made were obtained from the ground by a motion picture camera equipped with a 17 in. telephoto lens. The camera trained on the spinning plane was kept stationary and many of the pictures were accurately timed by a chronograph connected with the camera record.

Forcing the Spin

Airplanes balanced at less than twenty-five per cent of the mean aerodynamic chord have generally recovered easily from tail spins, and, indeed, been difficult to throw into them. Therefore, the first flight tests were made with the balance considerably ahead of the twenty-five per cent position. Gradually the balance was moved rearward, a small amount between each flight. Both airplanes spun regularly at a rate of about two seconds per turn with light load balanced at twenty per cent of the mean aerodynamic chord. Under full load condition, with the balance at about thirty-five per cent of the mean aerodynamic chord, the O-1 spun very irregularly at a rate of about three seconds per turn and the O-2E4 very irregularly at a rate of about two-and-one-quarter seconds per turn.

The O-1 spun with its longitudinal axis varying from fifty-five to thirty degrees to true vertical as the load and balance were changed from light to full load condition. The O-2E4 spun with its longitudinal axis varying from twenty to fifty degrees to true vertical as the load and balance were changed from light to full load condition.

Under light load conditions, both airplanes recovered quickly, in about 800 ft., the only appreciable difference between the two being that the control forces required were higher on the O-2E4 than on the O-1. As the load was increased and the balance moved rearward, the response became slower and the control forces required, greater. Both airplanes recovered in about 1000 ft. under full load conditions. At a balance location of about five per cent of the mean aerodynamic chord to the rear of the full military load position, both airplanes stopped spinning so slowly and the control forces were so high that they were considered unsatisfactory. Generally, lowering the outside aileron about double its usual motion with the opposite aileron neutral

GYRATING OVER WASHINGTON. An Air Corps Curtiss P-1 (Curtiss D-12 engine) performing a series of maneuvers over the capitol.

assisted recovery. Raising the outside aileron an equal amount with the opposite one neutral had no appreciable effect

The motion picture records confirmed the reports of visual observers that the spins under full load conditions were irregular both in time per turn and path. The photographs showed that the location of the axis of the spin varied considerably along the longitudinal and lateral axis of the airplane.

The D-12 engine could be kept running during a spin, but the Liberty stopped completely at the end of five or six turns. Both engines could be started by diving, the D-12 the more easily of the two. Lieut. H. A. Sutton, in charge of the theoretical investigations and tests and who has acted as pilot throughout the extensive tests, reported that there was no tendency toward being thrown from side to side of the cockpit in a spin, or toward leaving or being pressed against the seat.

These tests indicate that a staggered wing cellule is not a certain cure for unsatisfactory spinning characteristics, since the O-1 has a large amount of stagger, while the O-2E4 has none. The proportion of the tail length to span is virtually the same in both planes. The increase in the moment of inertia resulting from placing loads behind the rear cockpit was greater in the O-2E4 than in the O-1.

Tests made on the O-2E4 with bombs mounted under the wings and the balance at thirty-four and six-tenths per cent of the mean aerodynamic chord resulted in a spin that could not be stopped or appreciably changed in 3000 ft. Dropping the fuselage ballast, which moved the balance forward, resulted in immediate recovery. Releasing the bombs would have accomplished the same result as the plane had been successfully spun with the above balance but without the bomb load.

Since facts pertaining to tail spins can be secured with comparative ease and safety by flight testing, this method will continue to be followed and it is hoped shortly to make available more accurate data than now exists on this subject for use in the development of future designs.

In Conclusion

The results of flight tests to date appear to show conclusively that mass distribution is the controlling characteristic. Large lateral moments of inertia, such as exist with tanks in the wings, or with wings of large span, make recovery difficult if the center of gravity is too far to the rear. With smaller lateral moments, the center of gravity may be placed farther to the rear before recovery becomes difficult. With normal lateral moments there is a maximum rearward position of the center of gravity beyond which recovery becomes difficult. All these predictions refer to biplanes, whether or not the wings are staggered. The influence of stagger does not seem pronounced. Wind tunnel investigations by the National Advisory Committee for aeronautics, however, lead to the hope that difficulties in recovery from spins will not be experienced in monoplanes.

Aircraft Exports for February

The domestic exports of aircraft and engines from the United States for the month of February, 1927, are as follows:

Countries	Engines for aircraft Number	Dollars	Airplanes, Seaplanes & other aircraft Number	Dollars	Parts except Tires Dollars
France	.	.	.	.	100
Soviet Russia in Europe	.	.	.	.	36,103
Switzerland	1	10,000	.	.	.
United Kingdom	.	.	.	.	11,849
Canada	.	.	.	.	2,878
Argentina	1	5,016	.	.	249
Philippine Is.	.	.	.	.	427
Australia	1	25	.	.	.
Total	3	15,041	.	.	51,606

New Weather Broadcasting System

A new system of broadcasting aviation weather information has been inaugurated by the Navy Department which will make it possible for air stations to plan their daily schedules at least two hours earlier than is now possible. This will enable fliers to start cross-country flights with complete weather information early in the day, choosing routes to avoid adverse weather conditions and selecting the best time for flights.

The Navy, cooperating with the United States Weather Bureau, is transmitting daily by radio telegraph complete weather information for the Navy and other aviation activities. This service is the outgrowth of conferences at the chief coordinator's office attended by representatives of the Army, Navy, Department of Commerce, Weather Bureau, and the Post Office Department. It has been found by those in command of aviation units that the weather reports broadcast to Mariners by the Navy at 10:30 a.m. and 10:30 p.m. did not contain sufficient information for the planning of flights and were received so late in the day that fliers were beginning their flights without sufficient data on weather conditions to be met. This has resulted in numerous cases of forced landings because of bad weather and many times pilots have had to change their routes to fly around unpredicted storms.

Upon the recommendations of the Department interested, the Weather Bureau planned this service and funds to carry it through were asked from Congress. Provisions for the personnel and equipment were contained in the Second Deficiency Bill which failed of passage. To meet the needs of air stations, a partial service has been commenced and to avoid delay the Navy temporarily assigned to the Weather Bureau two aerologists, and certain equipment, and the Marine Corps assigned an expert operator for this aviation weather broadcasting. When funds are provided by Congress, the service will be broadcast twice daily and the morning broadcast will be duplicated at 8:15 p.m.

This service is sent out by remote control from the Weather Bureau through Arlington daily, beginning at 8:15 a.m. in the Weather Bureau word code, simultaneously on 8030 and 12,045 kcs (37.34 and 24.89 meters) to permit its reception throughout the country. The frequencies chosen appear best for daylight transmission. The broadcast will be made up from the regular Weather Bureau stations' reports which cover meteorological conditions throughout the United States, the Hawaiian Islands, part of Canada and part of the West Indies. Through this service the daily weather maps can be completed by aerologists at aviation fields by 9:30 a.m.

This service was given a trial test on April 15 and on April 18 the regular daily transmission was begun. Eleven naval stations equipped with short wave receivers have reported receiving the broadcast from the Weather Bureau with excellent results. These stations are: Boston, Mass.; Naval Air Station, Lakehurst, N. J.; Station, N. J.; Hampton Roads, Va.; Charleston, S. C.; Key West, Fla.; New Orleans, La.; Guantanamo Bay, Cuba; San Juan, P. R.; Brownsville, Tex.; Great Lakes, Ill.; San Diego, Calif.

The United States Fleet while in the Carribbean and on its way to New York reported satisfactorily on the service.

It is believed that this new service of broadcasting the weather reports within less than one half hour after the observations are taken will not only be of great benefit to commercial and military aviation, but that Boards of Trade, Cotton Exchanges and other organizations and individuals interested in crop production and prices will install short wave receivers at comparatively low costs and in this way be able to get weather information much earlier than is the case at present.

New Spanish Air Council

A superior aeronautical council was created by a decree of the Spanish Government issued recently. The council will supervise the development of military, Naval and civil aviation in that country.

The Bach C-S-1 three-passenger cabin plane (Super-Rhone, 120 hp.)

The Bach C-S-1 Cabin Plane

A Three-Passenger Enclosed Cabin Machine Designed for the Private Owner. Simplicity and Ruggedness are Features.

AN APPROACH toward the modern closed cabin touring airplane, suitable for private ownership, is very interestingly brought out in the design of the Bach C-S-1 airplane. The machine is a conventional biplane with enclosed cabin for three passengers including the pilot and is powered by a 120 hp. Super Rhone radial air cooled engine. The machine is of normal design and construction, the fuselage being of spruce structure with mahogany veneer covering. The cabin, which is surrounded by large windows, provides a wide range of visibility for the pilot and passengers, faired smoothly to fill the entire wing gap at the center.

Simplicity a Feature

The wings are also of spruce construction, employing conventional "I" section spars with built up web ribs and is fabric covered. The wings have a single interplane bay and ailerons are fitted on all four wing tips. In the design of the Bach C-S-1 every detail which makes for simplicity in maintenance has been given consideration. The control wires from the pilot's seat are enclosed but arranged so that inspection is a simple operation. The gasoline tank is situated in the upper wing center section, and the feed, of course, is by gravity. The wing is equipped with the normal type axle undercarriage with rubber cord shock absorbers.

The general details of the plane, together with the manufacturer's figures of performance are:

Useful load	800 lb.
Range	3 hr.
Wing area	220 sq. ft.
Span	28 ft. 6 in.
Chord	5 ft.
Gap	4 ft. 6 in.
Length	20 ft. 4 in.
High speed	107 m.p.h.
Cruising speed	90 m.p.h.
Landing speed	35 m.p.h.
Engine	Super Rhone
Rate of climb	500 ft. per min. to 5,000 ft. full load.

Charles F. Van Sicklen Joins Advance Force

The Advance Aircraft Company, of Troy, Ohio, manufacturers of the Waco planes, announce the appointment of Charles F. Van Sicklen as sales and advertising manager of their organization.

Mr. Van Sicklen comes to his new duties with many years of sales and managerial experience in the automobile industry.

DETAILS OF THE BACH C-S-1. On the left, the wood fuselage structure. Middle, a rear view of the fuselage structure. On the right, a three-quarter front view of the Bach C-S-1.

To Relinquish Air Mail Equipment

The Second Assistant Postmaster General, W. Irving Glover, announced on April 13 that the Post Office Department will maintain and operate its present air mail equipment until after July 1, the date the Government expects to relinquish its control over the Eastern Division of the trans-Continental air mail service between Chicago and New York City.

The Department, Mr. Glover explained, will, at the proper time, declare its flying equipment surplus property. The property, however, under the law, will be cleared through the office of the Chief Coordinator, who in turn will transfer it to other executive establishments. In case those establishments have no use for the equipment, which is made up chiefly of airplanes, a public auction sale will be held. The planes alone, Mr. Glover said, represent an original outlay of approximately $1,000,000. The postal service now owns eighty-eight Douglas and De Haviland planes, of which seventy-seven are in operating condition, and still good for approximately 51,843 hr. of flying.

Mr. Glover also made public a tabulation showing the location and condition of planes belonging to the air mail service as of April 1, 1927, as follows:

Division	Planes in Operating Condition Doug	DeH	Est. No. of Hr. Still Good	Hr. Sched. per Month
Eastern	18	6	17,740	882
Central	18	7	25,815	814
Mountain	5	2	6,401	289
Western	2	14	7,317	441
Repair depot	0	1	1,300	[illegible]
Totals	48	29	51,853	2,204

Will Survey Hudson Straits

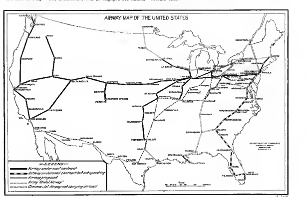
The Hudson Straits Air Survey Expedition, under the direction of the Royal Canadian Air Force, will leave Halifax on board the Canadian Government ship "Stanley" around the first of July. The detachment will be engaged for fifteen months on its work, which will involve flying under all kinds of weather conditions for the purpose of observing fog and ice conditions and the mapping of the country.

The first of the six Fokker seaplanes, which will be used on the expedition, reached Ottawa April 28, from Hasbrouck Heights, N. J. It was taken to Camp Borden. The remaining planes will be delivered shortly. The seaplanes will be tested during the Summer and placed in condition for the work in the North. Fifty officers and men of the R. C. A. F. will be engaged in this expedition.

Survey of Commercial Aviation Activities

An investigation made by the Division of Aeronautics of the U. S. Chamber of Commerce shows that 134 different cities, through chambers of commerce and commercial organizations have undertaken activities for the establishment of airports, the development of air traffic and transport facilities, the encouragement of aircraft production and the stimulation of the public use of air transport. The air mail is now being used by merchants, manufacturers, bankers and professional men for the transmission of a wide variety of documents and merchandise.

The development of the transportation of merchandise and passengers has not kept pace with the expansion of the air mail, but the air passenger and express business has made some progress during the past year. Reports received by the Aeronautics Branch of the Department of Commerce show that 5,782 passengers were carried by six airway operators handling passenger business and 1,844,455 lb. of express were transported by four airway operators handling express business. This is in addition to the 611,580 lb. of mail carried by sixteen air mail operators, including the Post Office Department. The number of passengers carried for hire by 218 aerial service operators rendering cross-country or occasional service, is reported at 219,963, while 36,624 passengers were carried free.



The most up-to-date and complete map of the airways of the United States.

Geared Down Propellers and the Efficiency of Commercial Airplanes

Better Performance Attained in Spite of the Increased Weight.

By RICHARD M. MOCK
Daniel Guggenheim School of Aeronautics, New York University.

Gears for driving propellers at less than engine speed have frequently been employed with a view to securing greater propeller efficiency, and hence better airplane performance. Both theoretical considerations and comparative flight tests indicate that geared down propellers may improve propulsive efficiency. The use of geared propellers entails certain complications such as increased weight, larger diameter of propeller, less ground clearance, difficult drive mechanism, additional stresses in the fuselage, and sometimes decrease in the pilot's vision. It is the purpose of this article to examine briefly the advantages of gearing from an efficiency point of view as well as to consider the attendant difficulties.

Theoretical Propeller Efficiency

The well-known expression for the aerodynamic efficiency of a propeller blade element, in the simple Drzewieki theory, neglecting the effect of air inflow, is

$$e = \frac{\tan \varphi}{\tan (\varphi + \delta)}$$

where, φ = the angle between the resultant wind and the plane of rotation of the propeller,

$\delta = \tan^{-1} D/L$, or the angle between the resultant of the lift and the drag of the element, and the lift as in Fig. 1. From this expression it can readily be seen that φ should be large and δ small. That is, the blade angle should be large, the airfoil efficient, and the angle of incidence such as to approximate the best L/D of the airfoil element employed.

Differentiation of this expression for e shows that maximum efficiency is attained when:

$$\varphi = 45° - \frac{\delta}{2}$$

Theoretically the blade angle should be close to 45 deg. In practical design it is rarely possible to use such a blade angle.

It is possible to get a better conception of the necessary coordination between the forward speed and the rotational speed by the following:

From Fig. 1, it can be seen that

$$\tan \varphi = \frac{V}{\pi ND}$$

Where V=forward velocity of the plane,
N=revolutions of the propeller per unit of time,
D=propeller diameter.

To get the desirable high values of φ, the forward speed of the plane should bear a large ratio to the rotational speed of the blade element. The expression V/ND is frequently used as an indication of this ratio. It follows that it is desirable to have a high value of V/ND.

The above expression for the aerodynamic efficiency is incomplete since it does not include the inflow of air. If the velocity of the inflow is v, the velocity of the plane is V, and the thrust is T, the propeller is doing useful work at the rate proportional to TV. The air meets the propeller at a speed (V+v) and the work which the engine gives to the propeller is proportional to T (V+v). Hence, the real efficiency of the propeller is

$$\frac{\tan \varphi}{\tan (\varphi + \delta)} \times \frac{TV}{T(V+v)}$$

$$\text{or} \quad \frac{\tan \varphi}{\tan (\varphi + \delta)} \times \frac{V}{(V+v)},$$

which is always less than the efficiency above. To keep $\frac{(V)}{V+v}$ high, we must have a low indraft into the propeller or in other words, a low slipstream velocity.

Since the thrust of the propeller is obtained by imparting additional velocity to the airstream, for a given thrust the slipstream velocity will be lower if the disc area is large. With a lower velocity in the slipstream the inflow will be less. Therefore, a large diameter propeller may help to raise the value $\frac{V}{(V+v)}$ and, thus, increase the efficiency.

The above cannot be considered as a rigid treatment of the problem. However, it will be conceded that to get a high propeller efficiency:

(1) high V/ND, i. e. high ratio of forward to rotational speed,
(2) large propeller diameter, are generally desirable.

Variation of Efficiency With V/ND

Fig. 2 gives the actual variation of propeller efficiency, as obtained by wind tunnel tests, with V/ND for a family of three conventional wooden propellers with geometric pitch/diameter ratios of 0.5, 0.7, and 0.9. From these curves it can be seen that as the pitch/diameter ratio increases, it is possible to get a higher maximum efficiency. Also that with greater pitch/diameter ratios the best value for V/ND increases. It would seem desirable, therefore, to use the highest possible value of V/ND for a given plane design, and to make the pitch/diameter ratio conform with these conditions. The practical efficiency tests are, thus, seen to conform with the above theoretical considerations.

Fig. 1 The relative forces at a propeller blade element.

A generalized curve of the efficiency against V/ND which shows the efficiencies that may be obtained with conventional wooden propellers is given in Fig. 3. The curve may safely be used in preliminary design.

V/ND on the Climb

Fig. 4 is a curve showing how the efficiency of a conventional propeller may be estimated when working under a V/ND condition which is only a fraction of its V/ND at

high speed. Table 1 indicates how much better the V/ND on the climb is improved by gearing. On the climb the sensitiveness of the propeller efficiency to V/ND is much greater than in the region of high speed. A slight change in the V/ND on the climb will have a greater effect on the propeller efficiency then it will at high speed.

As the rate of climb is determined by the excess horsepower, an increase in the horsepower available or a decrease in the horsepower required will result in a better rate of climb. When reduction gears are used, due to the higher propeller efficiency, giving more horsepower available and the lower slipstream velocity, reducing the horsepower required, the excess horsepower will increase with a corresponding increase in the rate of climb. A small increase in the horsepower available or a small decrease in the horsepower required will result in a much larger increase in the excess horsepower. An increase in propeller efficiency will cause an increase in the horsepower available. The large propellers, used at low speeds, reduce the slipstream velocity, decreasing the drag and, thus, decreasing the horsepower required. It follows that the rate of climb will increase faster than the increase in efficiency.

Typical Examples of Value of Gearing

In table 1 are given some calculations showing the possible gains obtained by gearing down 3:2 some typical airplanes, using the conventional curves in Figs. 3 and 4. The results of the table indicate that the improvements in efficiency are appreciable though not extraordinary.

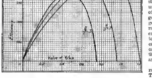


Fig. 2.
Variation of propeller efficiency with V/ND for three conventional wooden propellers of different pitch/diameter ratios.

Actually the improvement in efficiency will be somewhat better than shown by these figures, because:

(1) at high speeds, the extra power available will increase the high speed, and hence improve V/ND still further,

(2) on the climb the speed will increase slightly, with a corresponding increase in V/ND, and

(3) the reduction in slipstream velocity, due to the larger propeller, will decrease the parasite resistance.

The Take-Off Condition

At the take-off the larger diameter propeller gives a greater thrust (consider the enormous thrust developed by a large helicopter propeller) and consequently, a shorter length of run is obtained. For heavily loaded planes this may be an important consideration. In general, with geared down propellers, less attention will have to be paid to the problem of power on the take-off. When a reduction gear is employed, an otherwise overloaded plane may be able to take-off with ease.

The Reduction Gear

Since the War, there has been an increasing number of aircraft engines equipped with reduction gears. Almost

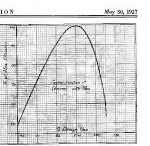


Fig. 3.
Generalized curve for efficiency against V/ND for conventional wooden propeller.

every water-cooled engine in production has a model made with a reduction gear. In this country the only users of engines with geared down propeller drives are the military services, the number of commercial planes using reduction gearing being negligible. This is mainly due to the fact that there are no American air-cooled engines in production using gears for the propeller drive. The cost of a geared OX-5 engine would be prohibitive as compared with the present price of this engine.

The most common type of reduction gear is the regular stub tooth spur gear. In a spur gear drive one of the gears is usually mounted with a flexible coupling to absorb the shocks of the gear train. The Lorraine-Dietrich engine and some geared Liberty engines use an epicyclic gear train. Epicyclic gears do not effect the line of thrust, while some spur gears raise the line of the thrust from eight to ten inches. The increase in propeller diameter, when gearing is employed, is up to two feet. It can be seen that, while epicyclic gears may cause a decrease in the ground clearance spur gears might cause an increase in such clearance. It has been found that the power lost in gearing is usually greater when spur gears are used.

The possibility of using a reduction gear in an air-cooled radial engine is more difficult than with water-cooled designs. The natural type of gear to use is the epicylic type, since it is symmetrical about the propeller axis. The main difficulty is then in cooling the engine with a gear housing in front of the cylinders.

Additional Weight due to Gearing

One of the chief objections to the geared propeller drive is the increased weight. For the Packard Type 1550-600 hp. engine, the increased weight of the geared engine over the

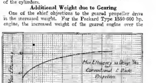
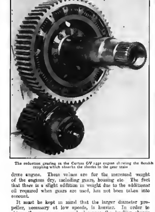


Fig. 4.
The efficiency of a conventional propeller when working at a V/ND that is only a fraction of its V/ND at high speed.

same model direct drive engine is 12.9 per cent, while the increased weight in their Type 2500-800 hp. engine is 15.3 per cent. The Curtiss GV-1550-575 hp. engine shows an increase in weight of 15.3 per cent over the similar engine with a direct propeller drive, the V-1550-600 hp. The increase in weight due to gearing is notably less in European engines. The Farman 500 hp. and the Renault 480 hp., both employing spur gears as do the Packard and the Curtiss, show an increase of 11.1 per cent and 8 per cent, respectively. The Lorraine-Dietrich 450 hp. engine, employing epicyclic reduction gears, shows an increase in weight of 12.1 per cent for their geared model over a similar direct



The reduction gearing in the Curtiss GV-1550 engine showing the flexible coupling which absorbs the shocks in the gear train

drive engine. These values are for the increased weight of the engines dry, including gears, housing etc. The fact that there is a slight addition in weight due to the additional oil required when gears are used, has not been taken into account.

It must be kept in mind that the larger diameter propeller, necessary at low speeds, is heavier. In order to obtain the necessary ground clearance the landing chassis may have to be higher. Besides increasing the weight, this higher chassis will increase the parasite resistance. The higher chassis might be considered an advantage. For landing purposes, it gives the wings a higher angle of attact on a three point landing and, thus, due to the increased drag of the wings, the braking effect of the wings is relatively increased.

In deciding whether the weight per horsepower for the geared propeller gives sufficient saving over the direct drive propeller, the horsepower available (the brake horsepower times the propeller efficiency at that speed) should be used. The weight should include the additional weight due to the gears, the larger propeller, and the higher chassis.

The Case of The Caminez Engine

The main reason for using reduction gears is to produce the same power at a lower rotational speed. In the Fairchild-Caminez engine this is obtained by substituting a double lobed cam, mounted on the drive shaft, for the crankshaft commonly employed in internal combustion engines. Roller bearings, mounted on the wrist pins of the various pistons,

TABLES

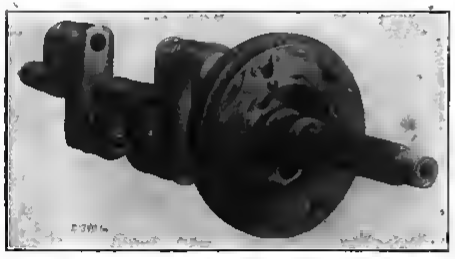
Table 1

		Ungeared propeller										Geared down propeller 3:2				
Name of Plane	Engine and hp	Propeller diameter ft	Maximum speed of plane m.p.h	R.p.m. of engine at maximum speed	V/ND at maximum speed	Conventional propeller efficiency at maximum speed	Speed on the climb m.p.h	R.p.m. of engine on the climb	V/ND on the climb	Conventional propeller efficiency on the climb	Propeller diameter ft	V/ND at maximum speed	Conventional propeller efficiency at maximum speed	Approximate V/ND on the climb	Approximate Conventional propeller efficiency on the climb
Fairchild FC1 cabin monoplane	OX5 90 hp.	8.5	82.0	1550	548	72 %	43	1400	318	50.3%	9.54	73.2	77 %	426	73.1%
Dayton Wright TA 5	Lawrence J-1	8.687	103.8	1780	590	72.5%	80.3	1630	555	72.8%	10.25	74.8	77.3%	705	76.6%
Consolidated TW3	Wright E 180 hp.	8.5	102.0	1745	612	74 %	67.5	1635	426	59.8%	10.0	78.0	78 %	546	63.5%
DH4	Liberty "12" 400 hp	9.833	123.7	1700	653	75 %	89	1475	502	65.6%	11.8	81.4	78.9%	630	80.1%

Table 2.
Performance Test on L.W.F. T3 Transport
400 hp. Liberty Engine

	High speed at ground			Climb at ground					
	r.p.m.	m.p.h	% increase in speed	r.p.m.	m.p.h	ft./min.	% increase in rate of climb	Service ceiling ft.	Absolute ceiling ft
Direct drive	1795	98.7	—	1980	88.2	280	—	9 650	10 300
5:10 epicyclic reduction gear	1858	102.7	4.05%	1880	75.9	550	96.4%	10 400	12 050
3:1 spur reduction gear	1900	108.0	9.73%	1655	71.2	918	131.0%	9 800	11 400

are kept in constant contact with this cam, its shape being such that for each revolution of the main shaft each piston will complete four strokes, or a complete combustion cycle. Due to the fact that each piston makes four strokes per revolution of the shaft instead of two as in the crank engine, the cam engine has the advantage of the geared engine without incurring the increased weight, the complication, and the cost of the geared engine Low propeller speed is thereby, obtained with high power output per unit of piston displacement



The Lorraine-Dietrich reduction gear

Due to the fact that the main shaft turns at half speed (as compared to the crank engine) the valve cams can be mounted directly on the shaft, thereby eliminating the additional weight and complication of another camshaft and the intermediate gearing commonly used. The Fairchild-Caminez engine is an air-cooled four cylinder X engine weighing 360 lb It develops 150 hp at 1200 r.p.m It may be well to note that, due to the cam replacing a crankshaft, the effective gearing is 2-1. In table 1 a ratio 3 2 was used for the gear reduction. A 2 1 ratio will result in a still greater increase in efficiency.

Performance Tests

Tests were made by the Navy at Hampton Roads, Va. and by the Army at McCook Field on the comparative performance of planes using geared and direct drive propellers. The Navy tests were made on two F5-L boat seaplanes. One plane was equipped with two direct drive Liberty engines, while the other had two similar geared drive engines. After a series of tests, the engines of the two planes were exchanged and the tests repeated The following resume of the results gives the average change in performance due to the substitution of the geared propeller drive for the direct drive in an F5-L.

(1) Time to take off—10 percent decrease.
(2) Climb in 20 min—20 percent increase.
(3) High speed—3 5 percent increase

The propellers used showed an efficiency of 70 percent and 78 percent for the direct drive propeller and the geared drive propeller, respectively

For the comparative performance tests made at McCook Field on L W F. T-3 transport plane was used. The tests were made for high speed and climb using a direct drive, an epicyclic reduction gear of 5 3 ratio, and a spur reduction gear of 2 1 ratio A tabulation of the results is given in Table 2 The improvement in performance for the tests is much better than for those made on the F5-L seaplanes. The McCook Field results show that the spur reduction gear ratio of 2 1 gives a higher efficiency than the epicyclic reduction gear using a ratio of 5 3 The increase in high speed is slight while the rate of climb is increased appreciably.

Conclusion

The reduction gear has the advantage of a better performance, giving a higher maximum speed, a better rate of climb, and shorter run on the take-off. A geared propeller gives greater thrust than the corresponding direct drive propeller. This feature is of considerable importance when it allows an otherwise overloaded plane to take off. When gearing is used, a smaller engine might be employed to give the same performance The smaller engine will have a lower fuel consumption and thus increase the flying range accordingly.

With the advantages of a reduction gear certain complications arise. With the gear driven propeller there is always the increased weight accompanied by the problem of decreased ground clearance or a higher landing chassis. There are the additional complications in the engine design due to the gear mechanism and the additional stresses involved. The gearing is always a potential source of mechanical trouble The additional expense of the geared engine is often the deciding factor in commercial planes.

When a reduction gear is advisable, is chiefly a matter of opinion. Some designers claim it inadvisable if the propeller efficiency is increased less than 5 per cent, while others prefer a loss of 10 per cent to the complications of a reduction gear. The point of overall weight per horsepower, as described above, is a helpful criterion With the increasing popularity of radial air-cooled engines, reduction gearing will not come into its own until the gearing for air-cooled engines or its substitute is fully developed

Denver Prepares for Balloon Race

The City of Denver is preparing for its first balloon race. As has been previously announced, the James Gordon Bennett International Balloon Race will be held in Denver Sept. 10. Because of the lateness in selecting the site, the National Aeronautic Association has announced that entries will be held open until June 1. They were to have closed May 1.

At the request of the Aviation Committee of the Denver Chamber of Commerce, two officials of the National Aeronautic Association, Ralph Upson, of Detroit, and Hugh Allen, of Akron, visited Denver to study technical, physical and meteorological conditions. They submitted a favorable report. The original date for the race was July 4. This was changed when Denver was selected, because of meteorological conditions being more favorable in September than mid-Summer

The matter of supplying gas with sufficient lift was one which baffled Denver for many months and which really prevented the city making an original bid for the race earlier this year The lift of the city gas supplied by the Public Service Company was found insufficient and the supply of hydrogen was declared too small to be practicable in such large volumes. This was, however, adjusted when it was learned that by shipping gas bottles from the government depot at Ft. Worth, Tex., enough hydrogen could be manufactured locally by the electrolytic process to serve balloons.

The ratio of hydrogen gas to the ordinary water gas supplied by the city mains will be sixty to forty. The gases mixed in this proportion will give a lift of at least forty pounds per thousand cubic feet.

In order to induce as many countries to enter as possible, it was Upson's recommendation that Denver offer a bonus of $500.00 for each country, other than the United States, which is actually represented in the race. This $500.00, in case more than one contestant enters, is to be divided equally among the entries of the country. An expense bonus of $300 00 for each contesting pilot has been offered besides. Prizes totaling $3,000 00 have been guaranteed by Denver, these to be divided into five or six individual parts in a manner to be determined later. The site of the race has not been determined as yet. Several suitable places are under consideration, one of these being the race track in the Denver City Park.

The race is to be financed by subscription among Denver business men, it has been decided. The city and county of Denver have already appropriated $5,000 00 through official action of its City Council. The balance will come from interested Denver citizens

Night Flying Equipment for the Airdrome - Part II

Landing Field Floodlights—A Discussion of the Various Methods of Floodlighting, Comparing Merits

By WILBUR T HARDING*

THE GREATEST question in dispute at the present time is in regard to the best method of illuminating the landing area of an airdrome Various types of equipment have been designed to accomplish this and each in turn has its merits. If illumination of a large area is all that is considered the answer would be one thing. But, if the entire aspect of the subject is considered, the answer may be quite different In May, 1926, at McCook Field, Dayton, Ohio, there were conducted extensive comparative tests upon practically every feasible method of illuminating a landing area Briefly the various arrangements were compared with

Fig 8. Lighthouse lens floodlight upon trailer

each other by various skilled test pilots and observers, to determine which arrangements were the best adapted for use Incandescent and arc lights were both used, but it was decided to eliminate the arc light entirely from the consideration for the following reasons

a The high intensity, full automatic, or semi-automatic arc light requires the constant attention of a skilled operator

b A motor generator set is required for the arc light

c The initial cost is high, as well as the operating cost.

d. The unit is not reliable as the arc may go out, leaving the airdrome dark for some time before it can be started again

e. Incandescent lamps are more readily controlled from remote points

If illumination alone is considered, the following gives, in order of preference, the best arrangement as determined from the comparative test.

Fig 9 Lighthouse lens floodlight upon hangar

Large Fresnel Lens Floodlight. A floodlight was made using 180 deg of the central portion of a first order lighthouse lens. This lens is approximately 6 ft in diameter and 40 in high, and is of a precision ground construction. The arrangement is shown by Fig 8. This unit was tried in various combinations, the best of which was found to be with the floodlight upon a horizontal platform 30 ft. above the ground. A 10 kw., 110 volt, incandescent lamp was used, so placed out of the true focus as to illuminate the landing area Fig 9 shows the installation made for this test. A very large area was adequately illuminated and safe landings could be made in any direction, although it is not desirable to land directly into the light

Boundary Projector Floodlights. The second best arrangement proved to be a row of projectors each of 40 deg horizontal spread and using a 1500 watt lamp These units were placed in a row and an area approximately 1400 ft long and 1000 ft wide was illuminated Figs. 11 and 14 show two types which are satisfactory

Fresnel Lens Boundary Floodlights. The units, which proved next satisfactory, were small pressed glass, 120 deg Fresnel lens units, each equipped with a 1500 watt lamp and a spherical reflector Fig 16 shows this unit A row of these was arranged to illustrate an area 1200 ft long and 700 ft wide.

Large Projector. The least desired where illumination is concerned, is a 36 in parabolic projector, fitted with a 40 deg spread lens and a 10 kw. lamp. This was mounted along the boundary approximately 50 ft high Fig 17 shows the unit installed

The consideration of illumination alone, however, was not final in the determination of the best general system Floodlighting equipment should meet the following basic requirements which are arranged in their relative importance

Safety. The arrangement must be such that sufficient illumination is produced with a minimum of glare, to enable a pilot unfamiliar with the field to make a safe landing

Reliability. The arrangement must be such that its operation will be reliable and that no unnecessary delays are involved in securing its successful operation.

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* Electrical Engineer McCook Field Dayton Ohio In charge of the development of Night Flying Equipment for the U S Army Air Corps Public acknowledgment is here made by writing to Donald L Bruner 1st Lieut Air Corps who gave personal instruction in the fundamentals of the use of night flying aids from the air and to the U S Army Air Corps for the use of various official photographs

Adoptobility. Due to the fact that each airdrome presents a unique problem characteristic to that field, the arrangement must be such that it can be adapted to various sizes and shapes of fields, and in particular to the contour of those fields which are often quite irregular. The nature and location of the power available is a very important factor which is usually overlooked until it is desired to operate the floodlight.

Controllability. It is desired to use only such a system as will readily be controlled from a central point so that the equipment may be used immediately, if necessary.

Cost. A consideration of the cost of operation and installation must be made in order that a cheap and economical arrangement may be adopted.

When each of the above requirements was considered, a revision was made in the arrangement to determine the best general arrangement. The results of tests to date show that the following arrangements are the best in respect to the requirements, and the various arrangements are discussed in order of preference:

Boundary Projector Floodlight. A type of unit similar to Fig. 10 or Fig. 11 will give very satisfactory results if installed properly. The unit with a special 1500 watt lamp, has approximately 40 deg. horizontal spread with a maximum beam candlepower of approximately 250,000 cp. When supplied with louvers, the cutoff along the top of the beam is very sharp. The internal arrangement of these two types is shown by Figs. 10 and 15. These units may be supplied with chromium plated reflectors which are durable and easily cleaned. The units are moisture and dust proof and require little attention. Simple focusing devices are supplied.

Each unit should be striped with alternate orange and black bands to increase the daytime visibility. Experimentation with various color combinations has shown that two colors, each in itself very prominent, should be combined to give as great a contrast as possible, for maximum visibility. Black and white reacts very favorable but has the disadvantage of losing its effect when the white becomes dirty. Orange and black reacts equally as well and the orange retains its color and its contrast to the black to a better advantage.

The unit is readily mounted upon hangar or upon a 2½ in. pipe standard. Each unit should be mounted 10-15 ft. above the ground. If the 1500 watt, 32 volt G-40 lamp is used it will be necessary to use four units in a row, spaced 300 ft. apart. If a lower wattage lamp is used the spacing should be varied to produce the same results and more units used. Failure of one lamp will not hinder a successful landing. Landings can be safely made, preferably parallel to the row, 300 to 1000 ft. out.

Two rows of four each should be used, each row at right angles to the other, and one of the other row, but not both, should be used according to the wind direction. The proposal to use rows on opposite sides of the field, is not satisfactory as the pilot is more troubled by the resulting glare than helped by the increased illumination. Landing should be made parallel to the row if possible. Each unit costs approximately $200.00, making a total of $1600.00 for floodlights for a given field.

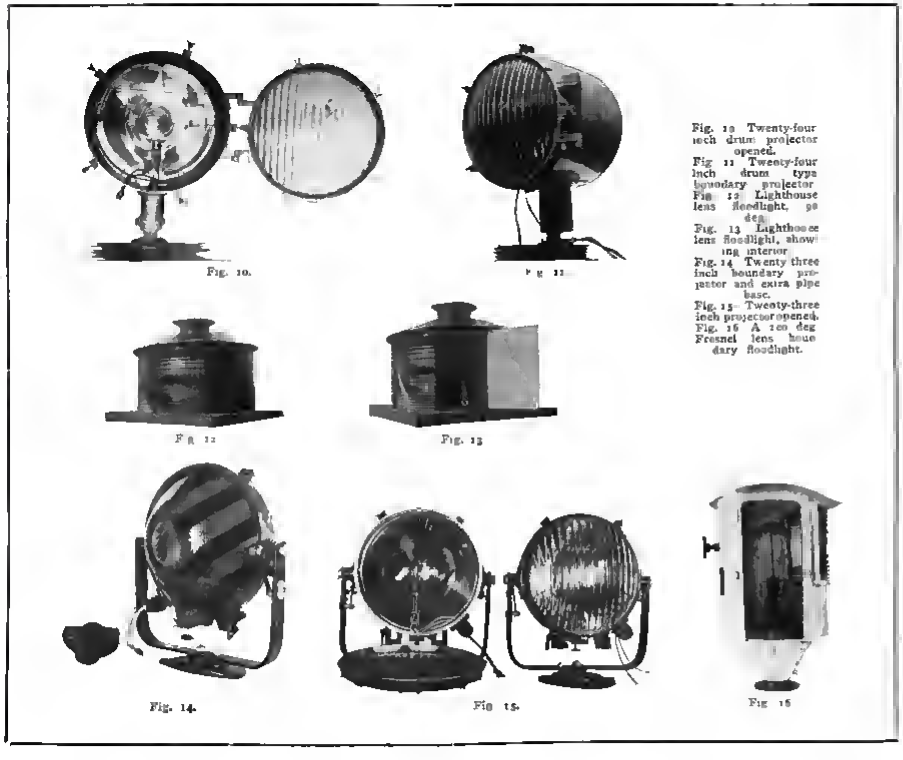


Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

Fig. 10. Twenty-four inch drum projector opened.
Fig. 11. Twenty-four inch drum type boundary projector.
Fig. 12. Lighthouse lens floodlight, 90 deg.
Fig. 13. Lighthouse lens floodlight, showing interior.
Fig. 14. Twenty three inch boundary projector and extra pipe base.
Fig. 15. Twenty-three inch projector opened.
Fig. 16. A 120 deg. Fresnel lens boundary floodlight.

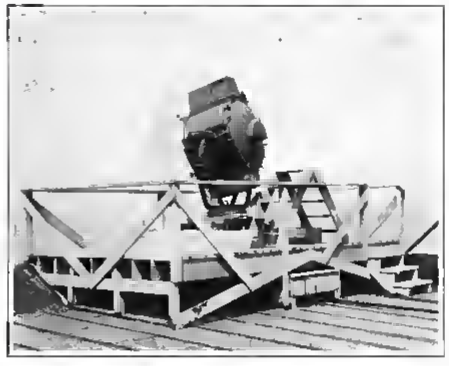


Fig. 17. A 36 in. drum projector mounted on hangar.

When the 1500 watt lamp is used it is connected to a small lamp transformer which is fed from an underground circuit. Consideration of installation cost should include equipment to transformer, with controls at some convenient central point. The cost of operation of such a row of four units considering 250 hr. life for the lamps, and power at $0.05 per kw. hr. is approximately $0.40 per hour.

Fresnel Lens Boundary Floodlights. The next desirable arrangement consists of a row of 120 deg. Fresnel lens floodlights. Each unit has a pressed glass Fresnel lens mounted in a cast aluminum housing and supplied with a glass spherical reflector, see Fig. 16. The light source is placed at the locus with the center of curvature of the mirror at the filament center. Louvers are not necessary. There is no direct light from the source and the cutoff along the top of the beam is such as to allow a safe landing with little or no glare. The horizontal spread is approximately 120 deg. and the maximum beam candlepower, with a 1500 watt, 32 volt lamp, is approximately 50,000 cp. The unit is readily focused and may be mounted upon a 2 in. pipe standard. The unit is not as dust or moisture proof as the projectors and will require more maintenance. Each unit should be striped orange and black for daytime visibility. Each should be mounted 10-15 ft. above the ground.

With a 1500 watt, 32 volt lamp it will be necessary to use four floodlights in a row, spaced 200 ft. apart. This will illuminate an area 1200 ft. long and 700 ft. wide. Landings can be made 300 to 700 ft. from the row and should be in a direction approximately parallel to the row. Two rows are required to take care of wind direction. Each unit costs approximately $150.00, making the total cost of floodlighting equipment, less mounting, $1200.00. This unit is adapted particularly to small fields in which the limited lighted area is no serious handicap.

The cost of operation and installation for a given field is approximately the same as for the projector type.

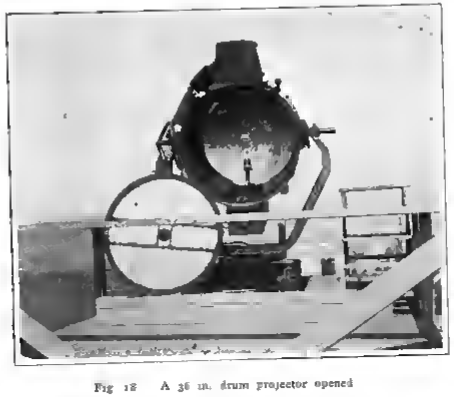


Fig. 18. A 36 in. drum projector opened.

Large Projector. This unit is a 36 in. parabolic reflector fitted with a horizontal spread lens of 40 deg. divergence. Fig. 18 shows the unit opened and the 10 kw. lamp in focus. The light source used in such a unit is a 110 volt, 10 kw. C-80 monoplane ribbon filament, incandescent lamp. This lamp at the present time is under development and will eventually have an average life of 100 hr. The unit should be mounted upon a hangar 30 to 50 ft. high and a limited area 600-800 ft. from the hangar should be illuminated.

To secure reliability of service two such units should be mounted together and one unit used as a spare. The 10 kw. lamp requires a special starting device which automatically places the lamp upon subnormal voltage by means of a series resistance which at the end of 45-60 sec. is shorted by means of contactor operated by a time delay relay. When this happens the lamp operates upon normal voltage. This lamp

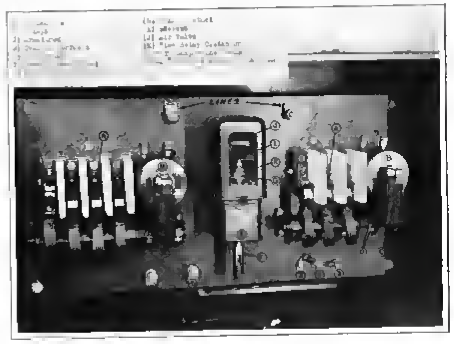


Fig. 19. A 10 kw. lamp starter.

starter, shown in Fig. 19, has a remote control and operation may be started or stopped at one or more desired points. The proper electrical installation would be to extend the field primary to the mounting platform—if practical—and install two projectors, each controlled by a separate contactor. In case of failure of one lamp the second may be started and in operation with a delay of approximately one minute provided the operator remains at the control switches. An airplane may land just outside the lighted area and then roll into the beam. This allows only one installation for all wind directions. The installation should not be made upon fields whose contours are quite rolling, however, as the unevenness of the ground where the landing is made is not discernable.

The cost of the equipment is quite high. Each unit costs $2000.00, each contractor, $200.00 and the transformer $100.00, approximately. The total cost of installation, without cable or primary or control circuit, is approximately $4500.00. The 10 kw. lamp costs approximately $100.00 each at the present time.

The operating cost also is high. Considering 100 hr. life of lamps and $0.05 per kw. hour for power, the cost per hour is $1.50.

In respect to illumination, the large single projector was placed last on the list of preference. However, when cost of purchase, installation, and maintenance is considered, this unit was not placed last in the Air Corps rating, probably

due to the fact that transfer of the floodlight units could be effected from other Divisions of the Army without transfer of funds. It should here be said that in considering whether this type of unit or the following is to be preferred, the classification was made in accordance with the above basic requirements in which cost was a big factor. If cost is to be eliminated, this unit would undoubtedly come last as it has no outstanding features making it superior to the large fresnel lens.

Large Fresnel Lens Floodlight. Recent tests with the large Fresnel lens floodlight mentioned previously have indicated that a beam of 90 deg or 120 deg horizontal spread is superior to the 180 deg spread. When the beam is restricted to the smaller angle the pilot has a better chance to approach the landing area without being blinded by the glare. The revised arrangement, shown by Figs. 12 and 13, has 90 deg. of lens. The floodlight should be mounted 20-30 ft. high on a horizontal platform and the lamp adjusted to give the desired spread with the outer edge of the beam striking the ground 1000-1200 ft. from the floodlight. This can be done by placing the lamp behind the focus (away from the lens) and above the focus an amount necessary for the installation. Raising the lamp drops a cone of light on the ground and moving the lamp away from the focus (and lens) will increase the spread.

The light source used, the 10 kw. lamp, is subtended by a 90 deg. spherical reflector placed so that its center of curvature is at the filament center and the principal axis (radius to center of reflector) passes through the filament center and the principal axis (radius to center of reflector) passes through filament center and the center of the lens.

The illumination produced is very good and this unit is particularly adapted to fields with quite uneven landing areas.

For electrical connections, the same method as recommended for the large projector should be employed. It is desirable for reliability to use two units but the cost is nearly prohibitive. If one unit is used the system will be dependent upon the operation of one source and, upon failure of the same, a delay until the lamp can be replaced would result. For such an installation, the primary should be extended near the unit and a transformer for one load installed. A lamp starter previously described is required to operate the lamp.

The cost of the installation is high. Each unit costs approximately $6000.00, making the total cost of equipment, minus cable, and control, approximately $6300.00.

The operating cost is the same as the large projector and is $1.50 per hour for the same assumptions.

Note.—While the units as tested at McCook Field are not obtainable for private use, a similar Fresnel lens floodlight made of precision and high quality lens, is available in a smaller size. These units can be supplied with arc or incandescent lamps and the quotation given above was for this smaller unit.

Metal Propeller Development

(*Concluded from page 1130*)

at low price. A second consideration of importance is the actual service requirements, such as the method of assembling the various parts, interchangeability and the adaptability to fit various engine shafts.

One of the later designs incorporating many of the aforementioned features is illustrated in Fig. 8.

This consists mainly of a steel hub portion made in two halves to form a socket to center the detachable blades and having a plurality of shoulders for retaining the blades against centrifugal force. A detachable shaft sleeve is inserted into each half of the hub, thus providing a method of mounting and holding the two halves together, and likewise taper bored to suit the engine shaft. In order to adapt a propeller to any type of engine, all that is necessary is to provide a shaft sleeve properly bored to fit the particular engine. This greatly facilitates using a propeller on a wide variety of engines by simply substituting the proper shaft sleeve without further disassembling the hub and blades.

The hub being made in two halves allows easy forging practice as well as making each half alike, thus constituting a hub built up of two parts made from a single forging. Machining operations are greatly reduced and the cost of producing a hub of this form greatly cheapened.

At the outer ends of the hub when assembled with the blades, a pair of clamping rings are used to hold the ends of the hub together and since the hub is split in two halves enough resiliency is obtained to allow tightening down on the blades by the clamping rings to allow forming a rigid bearing between the hub and blades, thus preventing any tendency to allow separate vibrations between the blades and hub.

An exclusive feature invented by the writer is adapting these clamping rings for obtaining the vertical balance of the propeller after being assembled on the hub, by moving the weighted portion of the clamping rings consisting of the lugs with the bolt and nut around the hub on the blade axis. This provides a most practical improvement in the balancing method without the addition of other means to this end.

This type of hub, known as the Split Hub, has superseded the solid hub as previously described due to being cheaper to manufacture and because of the better facilities for assembling and balancing, since these are essential considerations for actual service usage. The Split Hub propeller with detachable blades as now in use by the U. S. Army Air Corps and the Navy has met the most exacting conditions and requirements, besides creating a demand for this type of propeller from the pilots who have had an opportunity of flying this type of propeller, due to its adaptability and of the method of changing the pitch to suit the plane and engine in actually providing greater speed when adjusted to properly fit the plane. It has been noted that this type of propeller, with the angles properly adjusted, has increased the speed on a Fokker observation plane from 122.6 miles per hour with the best wood propeller to 129 miles with the metal propeller. Also on an Engineering Division plane the CO-5 from 132 to 137 miles per hour. This would clearly indicate that a metal propeller is better adapted than a wood propeller for greater plane performances.

Another important means of utilization for an adjustable blade has been experimented with, whereby a propeller designed for a 400 hp. engine, being 10 ft. in diameter, has been cut off to 9 ft. 8 in., thus taking off two inches from each blade. By further increasing the pitch to offset the decrease in diameter, it has been utilized to operate on a 500 hp. engine, and has given very satisfactory results.

It is likewise possible to use a metal propeller of a single design for various types of planes with speeds varying from 100 to 140 miles per hour, this being a wide range of variation over the fixed blade wood propellers, due to the advantage gained from the use of detachable and adjustable pitch blades.

It will thus be seen that the adaptability of metal propellers with detachable blades is practically unlimited, besides offering advantages unobtainable with solid wood or other types of one piece propellers.

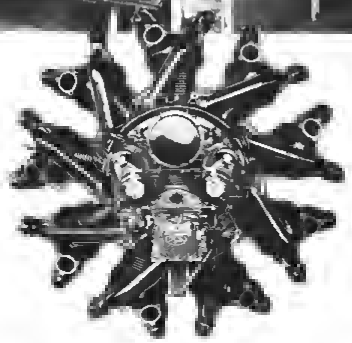
The foregoing description of metal propellers pertain to what might be termed the Semi-Adjustable Type in which the changing of the pitch of the blades may be accomplished only when the plane is on the ground. This method can only serve a single purpose as after the pitch is once changed the blades are then locked and held rigid in position and the propeller will then function the same as a fixed blade or one piece propeller. Thus if the pitch was changeable in flight at the will of the pilot much greater efficiency could be obtained from the propeller in regards to better climb and higher ceilings, due to the angularity of the blades being changed to suit the variation in the engine power delivered which varies at different altitudes, due to change in air density.

While practically all of the latest types of successful metal propellers manufactured in this country have been made from Aluminum Alloy, which is most commonly called Duralumin, nevertheless there have been several propellers made from a Magnesium Alloy, which is about one-third lighter in weight than Duralumin. This material is still in the stage of experimentation for further propeller development, and while insufficient data is obtainable at present, there is a possibility of this being a very satisfactory material.

Two views of the Scintilla factory, Sidney, N. Y.

An assembly rack.

A production test bench



The Pratt & Whitney WASP

THE ignition equipment consists of two Type AG 9-D Scintilla Aircraft magnetos, clockwise rotation and driven one and one-eighth engine speed.

SCINTILLA

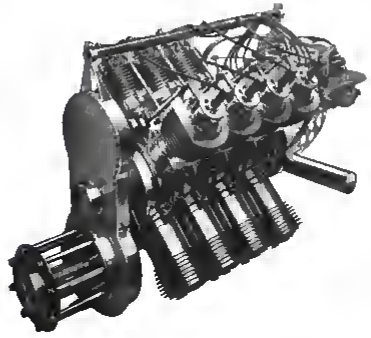
Aircraft Magnetos

SCINTILLA MAGNETO COMPANY, INC.

Contractors to the U. S. Army and Navy. SIDNEY, NEW YORK

THE TAFT-PEIRCE MFG COMPANY T-P WOONSOCKET, RHODE ISLAND, U. S. A.

1911 — 1927



Inventor's Model—8-cylinder aeronautical motor—built by Taft-Peirce in 1911. Completely machined throughout from solid billets of Krupp Steel. This engine developed 60 H.P.

The WASP—9 cylinder radial motor built by The Pratt and Whitney Aircraft Company. Tooled for production by Taft-Peirce. This engine develops 425 H.P.

THE scope of Taft-Peirce experience and the breadth of Taft-Peirce service are typified by the two motors illustrated above. In 1911 Taft-Peirce facilities for development work in this new industry were unique. They have kept pace with the phenomonal progress in aviation over the years between, until today the experience of the Taft-Peirce organization in this highly specialized work is invaluable. Their service is extensively employed by manufacturers of the three outstanding motors now in successful military and commercial use—motors that make records.

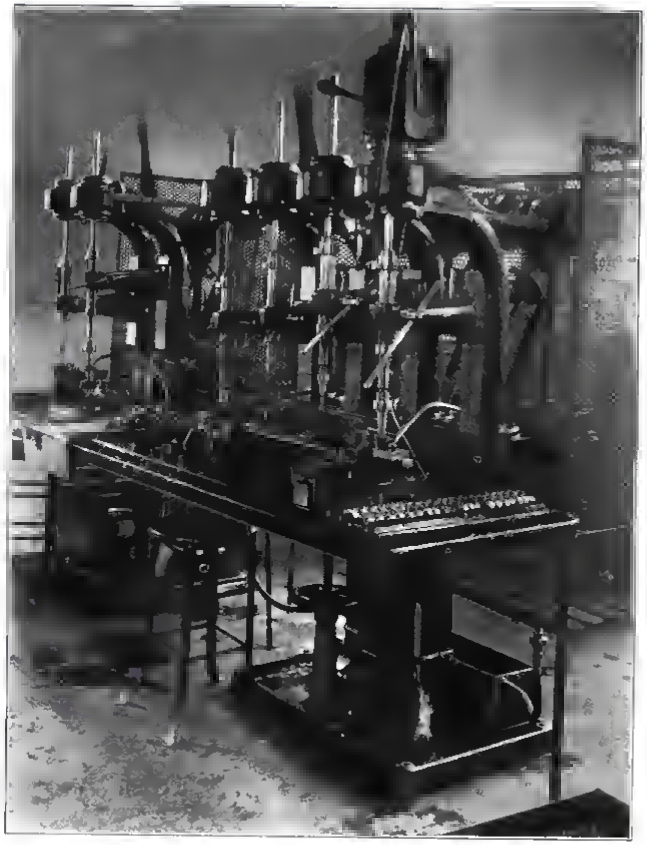
This service includes not only the manufacture of motor parts, but also the design and construction of the special tools used in the production of aviation motors. The same service—the same experience—the same facilities are always available to inventors and experimenters as well as manufacturers.

THE TAFT-PEIRCE MANUFACTURING COMPANY

MAIN OFFICE AND WORKS

WOONSOCKET, RHODE ISLAND, U.S.A.

Manufacturers of Tool Room Specialties, Gages, Magnetic Chucks, Reamers, Thread Milling Machines, etc., and Makers of Special Tools and Machines on Contract



Leland-Gifford Multiple Spindle Drilling Machines drilling, facing and tapping complete Wasp valve rocker arms. These quality machines meet the requirements of a quality engine.

LELAND-GIFFORD CO., Worcester, Mass., U. S. A.

Boston Chicago Cleveland Detroit New York Pittsburgh Rochester

LELAND-GIFFORD

Pratt & Whitey Powered

1 The new Glenn Martin Model 74 three-purpose Navy Plane powered with the Pratt & Whitney Hornet engine being inspected. Left to right in the picture are Bruce Leighton, aide to Asst. Secretary Warner; Lieut. S. Callaway, U.S.N.; Glenn L. Martin, designer of the plane; Asst. Sec. Edward P. Warner, (standing on wing), and L. C. Milburn, chief engineer of the Glenn L. Martin Company.

2 Lieutenants Calloway, Henderson and Barner standing by the Vought Corsair O2U-1 with Pratt & Whitney Wasp engine, in which the recent load carrying speed and altitude records were set up.

3. The Navy Vought Corsair (Pratt & Whitney Wasp engine) in which the recent World records were made

4. The powerplants. On the left, the Pratt & Whitney Hornet (over 500 hp. and on the right, the Pratt & Whitney Wasp (425 hp.).

5 The new Navy shipboard fighters now undergoing comparative tests. Left, Curtiss Seahawk. At right, Boeing fighter both powered with the Pratt & Whitney Wasp.

6 The Wasp engined Ford Stout single-engine air transport plane. At right to right, Wm. B. Mayo, chief engineer of the Ford Motor Co.; E. Rentschler, president Pratt & Whitney Aircraft Co.; Geo. J. Mead, vice-president Pratt & Whitney Aircraft Co., Colonel E. A. Deeds.

7 An aerial view of Brainard Field, the airport of the home town of Pratt & Whitney, Hartford, Ct.

8 The O-2E Douglas observation plane equipped with the Pratt & Whitney Wasp.

STANDARD PITTSBURGH PENNSYLVANIA STEEL PROPELLER CO.

ALL PRATT & WHITNEY

AIRCRAFT ENGINES ARE EQUIPPED WITH

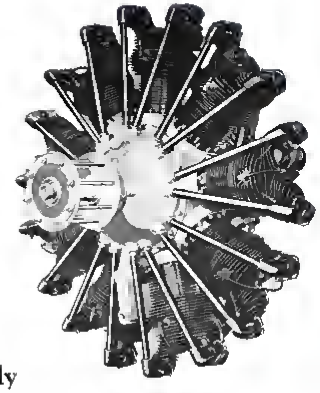
STANDARD STEEL

ADJUSTABLE PITCH PROPELLER HUBS

BEFORE LEAVING THE FACTORY—

STANDARD STEEL PROPELLER COMPANY

PITTSBURG, PENNSYLVANIA



Thompson Valves are used exclusively on Pratt and Whitney Engines. . . . . .

THOMPSON PRODUCTS, Inc.
CLEVELAND

Thompson Valves

Final inspection and assembly of SKF Bearings for Pratt & Whitney aircraft motors. The use of super-micrometer insures the extreme accuracy in these bearings.

AFTER exhaustive tests, the dependability and long life of SKF Bearings, have again been proven in aircraft motors.

As a result of the satisfactory performance obtained in these tests, the Pratt & Whitney Aircraft Company has selected SKF Anti-Friction Bearings to carry the important loads in their aircraft motors.

SKF INDUSTRIES, INCORPORATED, 40 East 34th Street, New York City

1830

More than 100 Factory Offices Throughout the World

SKF

Puts the Right Bearing in the Right Place

Ball Bearings **Roller Bearings**

ECLIPSE

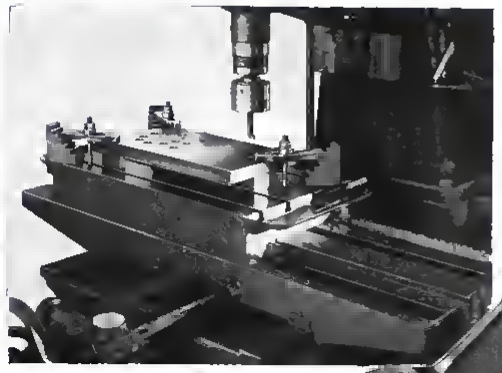
AVIATION ENGINE STARTERS

Eclipse takes pride in the use of its Series 6 Inertia Starter by the Pratt & Whitney Aircraft Company on the "Wasp" Engine.

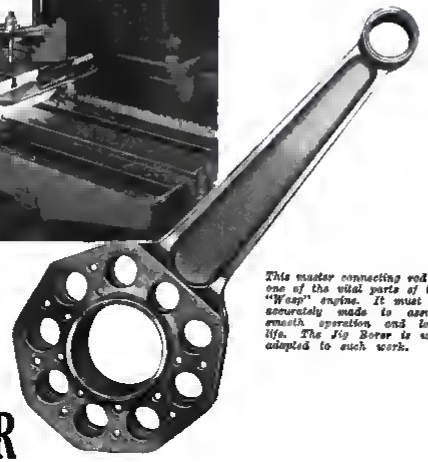
ECLIPSE MACHINE COMPANY

HOBOKEN PLANT

Elmira, New York HOBOKEN, NEW JERSEY Walkerville, Ontario



The templet shown on the Jig Borer table is used as a guide for accurately boring the master connecting rod in the "Wasp" engine Other jigs and fixtures used in making this fine engine were bored on the Jig Borer with a high degree of accuracy and in fast time



This master connecting rod is one of the vital parts of the "Wasp" engine. It must be accurately made to assure smooth operation and long life. The Jig Borer is well adapted to such work.

P&W JIG BORER and the "Wasp" break records

Here is just another instance of the usefulness of the P & W. Jig Borer. The master connecting rod of the "Wasp" engine must be accurately made. All pistons are operated from it — it is the very heart of the engine. Therefore, the templet used in producing this vital part had to be accurately made. It was bored on the P & W Jig Borer.

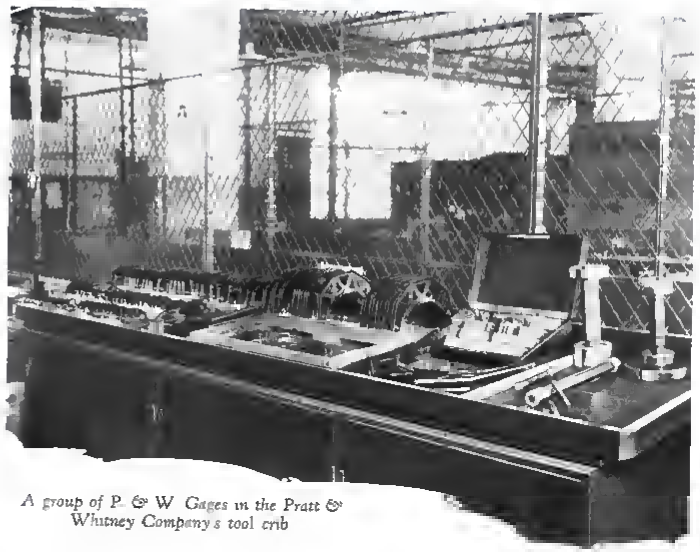
The "Wasp" as an aeroplane engine has proved a record breaker — and so has the Jig Borer. Every day in shops throughout the country, where the Jig Borer is being used new records are being made. It does its work accurately, and in such fast time that costs are often cut in half.

Have you jig, fixture, or precision boring work to do? If so, you need a Jig Borer. No other type of machine can equal it in accuracy or savings. Have a P & W Sales Engineer go over the details with you

The 400 h.p. P. & W. "WASP" engine has broken four World's records in as many weeks. The Jig Borer is breaking them almost daily.

PRATT & WHITNEY CO., *Hartford, Connecticut*
Division NILES-BEMENT-POND COMPANY

PRATT & WHITNEY



A group of P & W Gages in the Pratt & Whitney Company's tool crib

The "Wasp" is made to P&W Gages!

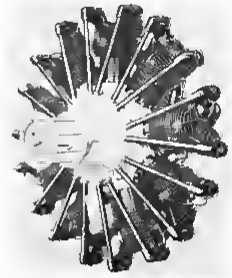
This "power plant of the air" — the "Wasp" engine, has established itself in the front ranks of aeroplane engines

That means the design is fundamentally correct, — and more. It means that every part is machined with an accuracy only lately known in commercial work. Infinite care is required to guard this accuracy through every operation so that all the parts co-ordinate perfectly.

The watch-dogs of "Wasp" accuracy are:

P & W Trilock Cylindrical plug and ring Gages, Trusform Snap Gages, Trilock Thread Gages, Adjustable Limit Pin Gages, Hoke Precision Gages, etc, which check every machining operation

What they do to assure accuracy in this engine, they can repeat in any manufacturing plant. Try P & W Gages. It doesn't matter whether the limits you work to are thousandths or fractions of thousandths, these Gages will check your work with accuracy, and last longer doing it. Ask us for details and prices.

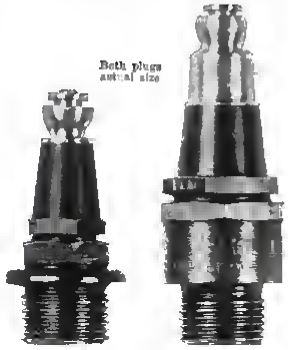


It takes highly accurate standards to make an engine that can accomplish what this P & W "Wasp" has done

PRATT & WHITNEY CO., *Hartford, Connecticut*
Division NILES-BEMENT-POND COMPANY

PRATT & WHITNEY

The HORNET Spark Plug
the latest B. G. *development*



B. G. Hornet *Usual Size*

THE AIRCRAFT ENGINE imposes particularly severe demands on the spark plugs. The engine must be capable of idling for considerable periods and must operate at high brake mean effective pressures. These conditions require the spark plugs to have an unusually wide temperature range through which they will operate satisfactorily, and this temperature range must be further extended to take care of widely varying temperatures in different types of engines.

The matter of mechanical strength to resist damage by accidental blows from tools and the like is important and, above all, it must be made impossible to blow out a damaged core because the flame emitted through the spark plug shell would constitute a serious fire hazard.

The B. G. Corporation has developed a mica insulated spark plug which has given excellent service and in general fulfills all the requirements. The plugs are supplied in types suitable for hot-running and cold-running engines.

The latest B. G. development, the Hornet Spark Plug, gives the additional advantages of a weight-saving of 4 lb. when applied to a 12-cylinder engine and increased clearance between the heads of the spark plugs and other parts of the engine and the cowling. The smaller overall dimensions of the Hornet also decrease the chance of igniting inflammable vapors by flashing from the high tension leads to grounded parts.

B. G. Hornet Spark Plugs show remarkable characteristics in the single and multiple-cylinder tests. Operating temperature range is very wide; fouling is unusual, and the spark plugs clean-up readily when the throttle is open. It is practically impossible to heat the spark plugs to preignition temperatures, even under the worst conditions in a single-cylinder Liberty 12 test engine.

These tiny Spark Plugs seem almost indestructible.

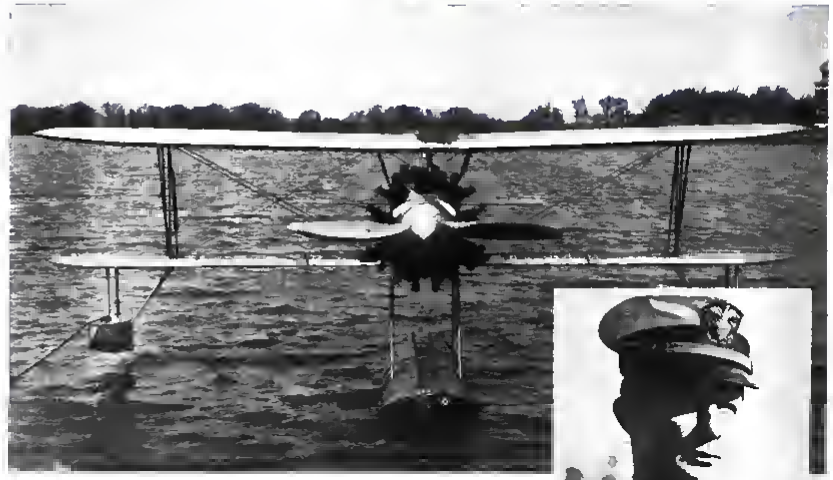
Representative users of
B. G. Spark Plugs—

U. S. ARMY AIR CORPS
U. S. NAVY AIR SERVICE
U. S. MARINE CORPS AIR SERVICE
ALLISON ENGINEERING CO.
ARGENTINE
ATLANTIC AIRCRAFT CORP.
CANADA (PROVINCIAL AIR SERVICE)
COLONIAL AIR TRANSPORT, INC.
CURTISS AEROPLANE & MOTOR CO.
FAIRCHILD-CAMINEZ CORP.
FAIRCHILD AERIAL CAMERA CORP.
FINLAND
FORD MOTOR CO., (STOUT METAL PLANE DIV.)
HUFF-DALAND DUSTERS, INC.
JOHNSON AIRPLANE SUPPLY CO.
LOENING AERONAUTICAL ENG. CO.
MACCHI COMPANY OF ITALY
MEXICO
GLENN L. MARTIN CO.
NATIONAL ADVISORY COMMITTEE
NEW ORLEANS AIR LINE
NORWAY
PACIFIC AIR TRANSPORT, INC.
PACKARD MOTOR CO.
PHILA. RAPID TRANSIT AIR SERVICE
PRATT & WHITNEY CO.
ROBERTSON AIRCRAFT CORP.
RUSSIA
SIAM
WALTER T. VARNEY
WRIGHT AERONAUTICAL CORP.

All 1926 Schneider Cup Race planes were equipped with B. G. Hornet Spark Plugs

THE
B.G.
CORPORATION
136 West 52nd Street
New York City, U.S.A.

Contractors to the U. S. Government Air Services and to the Aircraft Engine Builders



The Record Breaking Navy "Apache" Sea Plane ("Wasp" Engine)

Lieut. C. C. Champion, Jr. U.S.N.

The fourth WORLD'S RECORD made by the "Wasp"

On May 5th Lieutenant C. C. Champion, Jr., U.S.N., with a "Wasp" engine in the Navy "Apache" sea plane attained an altitude of 33,455 feet, the highest point ever reached by a sea plane of any type. This marks the fourth World's Record made by the "Wasp" in as many weeks.

This new record is additional proof that the characteristics of the "Wasp" engine are unequalled for high altitude performance.

THE
PRATT & WHITNEY AIRCRAFT CO.
HARTFORD CONNECTICUT

Dependable Engines

Aviation Signalling and Safety

The Value of Pyrotechnic Signal Systems in Aircraft Operation Particularly in Airport Control Work

By W. V. GILBERT

WITH THE impending rapid developments and extension of aviation generally the time has arrived when close consideration will have to be given to some aspects of flying which have hitherto received but scant attention.

One item that will require urgent investigation is signalling from and to aircraft. Some methods of signalling are, of course, already in use but they have not been codified, made uniform, nor obligatory. Nor is their use sufficiently extended. If this state of affairs be allowed to continue, it will lead away from safety; it may lead to chaos.

Such a situation would be deplorable, for safety is the principal objective. The science and practice of aviation is comparatively new. We pioneers want to see it come into its own and take the place in transportation, sport and utility that it will be abundantly entitled to. But (and here is the difficulty) the great majority of the peoples of all countries look at flying askance if not with fear. It is all right for the other fellow to fly, but the ordinary man, he will have none of it. The causes that have brought about such a situation are fairly apparent. How can they be removed?

Safety must become the pre-eminent objective of all the operators of aircraft as well as of the designers. Safety connotes many things besides the mere questions of design and strength of members. The term can have, and does unfortunately have, a very elastic meaning. The designer will think of it in terms of materials and disposition of materials and he, as far as his functions are concerned has not much else to consider. The operator will think of it from the point of view of how much weight of goods or how many passengers or how much mail he can transport at a profit. The pilot will think of it mostly from the point of view of taking off and alighting. But in the finality the views of the *public* must and will prevail, because it is to them that the makers and the operators of aircraft will have to look for an increased production demand.

Public Skepticism

The public are at present skeptical of flying. They read of the accidents that occur all too frequently. They know that no matter who is the maker of the machine, or what expense has been incurred in its building, or what care is exercised in its operation, there are an alarming number of accidents, many of them fatal, and they hesitate to adopt a means of transport which is not quite as cheap as the usual methods of getting about and is, to their minds at least, extremely risky.

So again ones thoughts are back at safety. Very rarely does a machine break up in the air. Such mishaps have occurred but it is well-known that the great preponderance of

PYROTECHNIC SIGNALLING APPARATUS

REF. NO	ITEM	WEIGHT	LENGTH	DIAMPTER	REF NO	ITEM	WEIGHT	LENGTH	DIAMETER
1.	Very Cartridge (Parachute) Type	7 oz.	9 in.	1 ½ in.	7.	Maroon (Cloud Piercing)	20 oz.	9 in	2 in.
2.	Very Cartridge (Short Thick)	3 ½ oz.	4 in.	1 ½ in.	8	Hand Torch (Alumag)	9 oz	11 in	1 ½ in.
3.	Very Cartridge (Small)	2 ½ oz.	4 in.	1 in.	9	Smoke Flare (Large)	45 oz	6 in.	3 ½ in.
4.	Very Pistol (Large)	8 lbs.		1 ½ in	10.	Wing Tip (and General Illumination)—Flare	16 oz.	9 in.	2 in.
5.	Very Pistol (Aviation) (Special)	3 ¾ lb.		1 ½ in.	11	High Altitude Rocket	16 oz	14 in	1 ¾ in.
6.	Very Pistol (Small)	2 ½ lb.		1 in.	12	Launching Tube (for Parachute Landing Flares)			

accidents to machines and passengers occur when the machine is landing, whether the landing be a forced landing or otherwise is not the material factor. Unforeseen landings are frequent. They may be caused either by the engine giving out, or by the supply of gasoline giving out, or the pilot may have detected some mishap in one or another part of the machine, or he may have overflown his destination or lost his bearings. With the general adoption of airplanes the latter will be a frequent cause of this type of landing. The unsafe moments of flying will in any case continue to be, in the main, the moments when the machine is about to alight.

Problems of Landing

It is with false landings that a great part of the trouble arises. The pilot is all right if he knows the landing field well and if the winds are fairly moderate and constant. One assumes that by far the largest percentage of landings will take place in daylight. But what if the landing field be unknown ground, what if the weather be misty, what if there are low flying clouds, what if there is a strong wind or gusty wind and the pilot is unaware of the intensity or direction? Remember that the wind on the ground level may be something of quite a different order to the wind at 2,000 or 3,000 ft. altitude or low lying mist may have blotted out the ground entirely, or heavy rains may have turned what otherwise should have been a safe landing field into temporary bog land. Under any one of such conditions the pilot would give a great deal to know with exactitude the actual state of affairs, and this can best be communicated to him by *visible signals*.

Signalling therefore will become the major thing in the attainment of safety. Of the various methods of signalling the one that can most readily and inexpansively be adopted is *pyrotechnic signalling*, that is signalling by devices which will give off smoke during the day time or by devices that will burn with an easily distinguishable light at night-time. Occasionally an additional effect may be needed, something that will emit sound or perhaps a combination of sound and light or sound and smoke. All such devices are in use to a limited extent already and especially are they in use in Great Britain and various other countries in Europe. Their use is being rapidly extended there but a danger lies even in this, and the danger is that unless rules are formulated and standardized and enforced chaos may result.

It would be well if some central authority would formulate rules for the consideration of the aeronautical bodies. At the outset the rules cannot be harsh or arbitrary; they must be drafted more in a spirit of educational progress.

But whatever the rules, whatever the manner of their inception, and whatever the extent of their use, the devices or apparatus utilized for carrying them out must be reliable, simple and consistent.

No apparatus or devices can live up to such requirements so well or so satisfactorily as pyrotechnic signals. The signals and the apparatus for handling and operating them can be made simple, safe, inexpensive, and light in weight and a thorough understanding of their use and operation is well within the comprehension of the ordinary individual. The code likewise would not be outside the scope of an ordinary intelligence. No Morse or other system of the kind would have to be learned. The technique would be quite elementary. No heavy or delicate or complicated parts are required. The interpretation of the signals nevertheless is definite and easy.

Take for example Very cartridges. These behave like rockets, but have not the disadvantage of the usual stick. They are light, easily stowed, easily handled, easily discharged. The cartridges are charged with stars or smoke balls to burn with different colors which are readily visible and distinguishable for miles. The Very pistol (sometimes called a rocket gun) which is used to discharge them is loaded just as one loads an ordinary shotgun and the pull of the trigger sets off the cartridges with like simplicity, readiness and lack of effort.

A red star could be discharged to mean "I want to land." A second red star might mean "What is the condition of the ground?" A yellow star might read "Do you want me to land?" A green star might mean "I am short of gasoline, have you any supplies?" The groundsman could reply with a white star or a star of any other color which would convey a definite meaning to the pilot aloft. This would be simple, unmistakable, inexpensive and quick. Of course if such inquiries or instructions were taking place in daylight a smoke ball cartridge would be used. The pilot would have to carry say six or twelve cartridges and one pistol. The landing field would require as part of its equipment a pistol and cartridges for its own signalling requirements and a small reserve of pistols and cartridges for supplying pilots as the need might arise. If the ground is obscured by a mist the groundsman could use a cartridge having a proportionately higher range of elevation than the normal Very cartridges, or the aviation Very cartridges could be standardized all to such a range as would render them applicable for general use.

When there are low lying clouds, visibility may be perfect on the ground; but clouds at a height of 2,000 or 3,000 ft. are in any case a bother to a pilot who wants to land. For such conditions the groundsman would have available a cloud piercing maroon made to give a compound sound and light signal. Such maroons will reach a ceiling of 1,500 to 2,000 ft. They are fired from a small mortar. The airplane pilot would first discharge a smoke ball, or light star, directly towards the ground or he could use a smoke flare which when dropped from the airplane would continue to burn for a minute or more. He would then circle about the position where he discharged the signal and the groundsman would fire his maroon in a direction away from such a position. One maroon might mean "quite safe to drop through the cloud, visibility is perfect to 1,000 ft."

As to signals peculiar to ground use, aluminum flares or torches of various sizes can be used to illuminate the landing field. They are readily portable and comparatively inexpensive. Smoke flares can be used on the ground to indicate the direction and intensity of the wind. Naturally they can also be used for other purposes. But it is desirable that any one signal should have a definite meaning. There are also wing tip flares. These are of considerable assistance to a pilot in an emergency landing at night. Reserves of these, as of the other signals, should be carried in the airdrome. These wing-tip flares have the special virtue that if the ordinary landing flares run out they can be used for emergency ground illumination purposes.

As to the functioning of the various devices. Very cartridges are set off by a percussion cap and are about the simplest of all pyrotechnic devices to use. Maroons are set off by a small friction tube. Flares, including landing flares and wing tip flares, can be set off electrically or by friction or by safety fuse. The percentage of failures in these pyrotechnic signals is so small that it is negligible, and they have the advantage that if there is a misfire or if for any other reason one fails to function the operator can see that it has failed and can discharge another one immediately.

More long distance flights have been attempted and are about to be attempted. It is a sad commentary on the present relative inefficiency of airplanes that it should be necessary to circumscribe loads so drastically. Whatever accessories have to be dispensed with, signalling apparatus should be retained. If an airplane alights on the water, the distance from which it can be seen by fishing boats or even liners, is very limited even in clear weather. But if the pilot had Very pistol and cartridges, the chance of his being picked up would be immensely increased. The star from the cartridges travels upward for several hundred feet and cartridges are made which give off easily discernible smoke clouds in daytime or very brightly burning colored stars at night-time which can be seen from the water level for many miles.

It is unfortunate, but very pertinent, that only quite recently we have been faced with situations where possibly the use of pyrotechnic signals might have saved valuable lives, if not also saved valuable machines.

And so, strange as it at first appears, we come to this—that pyrotechnic signalling devices are essential for the safety of aircraft; perhaps more important with respect to the successful conduct of general flying than any other single unit of equipment.

Collecting Insects By Airplane

Bureau of Entomology Develops Method of Using Airplanes for Collecting Insects at Altitudes

ENTOMOLOGICALLY it is of great interest to know the occurrence of insects in the air. Very little is known as to the height that insects fly and their relative distribution in various altitudes and the atmospheric conditions which govern their flight and distribution. Owing to the extreme difficulties in collecting insects very high in the air, very meager data has been collected. Collecting insects in high altitudes on the tops of mountains has been done frequently, yet the conditions are quite different since the insects may be carried upward by surface currents of air, and also the insects have the advantage of resting during their upward flight, and frequently find alpine flowers to feed upon, as well as snow water. A few collections have been made from lighthouses, but here the light attracts them upward and, furthermore, the lighthouse does not reach very high in the air. To collect insects thousands of feet up in the air at any desired place has never previously been accomplished.

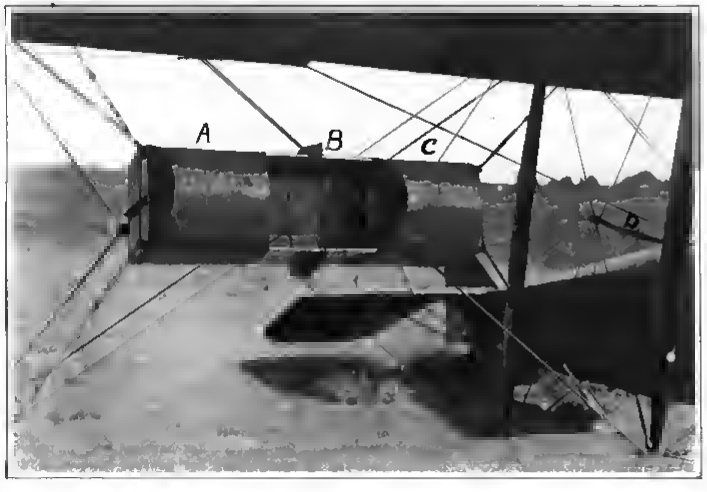
With the opportunity of using an airplane the Bureau of Entomology of the Department of Agriculture has given considerable thought to the possibility of devising a trap which could be placed on some part of the plane and used to collect insects at any desired altitude. Such a trap was developed after some difficulty in both adapting it to the wing of the plane so that it would not interfere with the control of the machine, and making it possible to manipulate the trap from the fuselage. It was also of equal importance to be certain that the insects taken at the desired altitudes would not be confused with each other and that they be kept separate.

The accompanying photographs will show the position of the trap on the wing of the plane and will aid in an understanding of it and its manipulation. The trap is divided into three compartments, A, B, and C, respectively. In (A) portion of the trap the screen trays (five in number) are placed. Wires connect each tray to the fuselage running into a conduit (D) to protect them from wind stream and to keep them in place. When a desired altitude is reached, say 5,000 ft., tray No. 1 is pulled into the open portion of the trap (B), and exposed for a desired length of time, then pulled into the compartment (C). The remaining four trays are pulled at the desired altitudes in the same manner, each tray being protected from any interference of wind currents or other factors. The trap is so made as to make it impossible for centrifugal force to pull the trays out of place. Each tray is covered with a thin coating of a mixture of castor oil and resin, in order to hold the insects in place as they come in contact with screen. The trays are ten by eleven inches in size and run in grooves in the trap which is made of aluminum, covered with tin and re-inforced with wood.

Eighty-three flights have been made with this trap and several thousands of insects taken. Altitudes ranging from ten feet above the surface of the ground to fourteen thousand feet up have been flown and in every altitude that the trays have been exposed insects have been taken. At this time the majority of the insects taken have not been identified. A few outstanding records are for general interest in demonstrating the practicability of method.:

Three cotton-leaf moths (*Alabama argillacea*) were taken at altitudes of 1,000 and 3,000 ft., two of the specimens being taken at the former altitude. A boll-weevil (*Anthonomous grandis*) was taken at 1,000 ft. Two tarnished plant bugs (*Lygus pratensis*) were taken at 1,000 and 2,000 ft. respectively. One honey bee (*Apis mellifera*) was taken at 1,000 ft., one damosel fly at 3,000 ft.; numerous "balloon" spiders were taken at altitudes ranging from 10 to 8,000 ft. A great many of the insects taken were very small Diptera and Hymenoptera, but mostly the former. In the higher altitudes from 5,000 to 14,000 ft. the insects are very small, including midges, chalcids or very small Coleoptera. It is most probable that the occurrence of these insects at the higher altitudes is not due to their direct flight, since the insects are very fragile and delicate, but possibly that they are carried up by the air currents and are at the mercy

A JN-4 airplane equipped with insect trap developed by the Bureau of Entomology. Note the conduit line carrying trap control to the cockpit.



A close-up of the insect trap rigged between the wings of the plane. For details of the trap see text

of these currents of air. Numerous other factors may enter in such as humidity, temperature, sunlight, wind velocity and cloud conditions. Many forms are rare and very different in appearance than those taken on the ground. It is possible that they may be carried from other parts of the country, thousands of miles away, even from Mexico or South America, etc.

It is confidentially expected that the value of the airplane in this work will grow rapidly.

Brownback Agents for Anzani Engines

For 1927-1928, the Anzani Company is marketing its engines through the Brownback Motor Laboratories of Norristown, Pa. The new designs of the Anzani engines do not differ greatly from former models, but are refined to a very high degree in small details, notably pistons, crankpin bearings, valves, rocker arm pins and mounts, lubricating system, etc.

Dusting Plane Development in 1926

DURING 1925 the all-metal fuselage came into very general use both in military and in commercial planes. This type of construction made the installation of dusting hoppers and agitation drive mechanisms easier to install in aircraft not specifically designed for dusting work, as it is little or no trouble to weld additional tubes or braces, whereas in the old type of wood fuselage it proved quite a problem to make such changes and maintain the original strength of the fuselage members in the bay where the hopper was located.

With the use of the all-metal fuselage a general change in the design of dusting hoppers has been effected. The new hoppers are of a larger capacity and it has been possible to give the desired slope to the sides to enable the dust to flow freely to the agitating mechanism and valve opening.

The funnel of the hopper has assumed some very decided changes. It has been removed from the top of hopper and placed under the fuselage where it is fastened to the bottom of hopper connecting directly with the valve opening. The funnel is oblong in shape and supported at the front and back to side tubes and the bottom of the fuselage. It is possible, with this type of funnel, to give the proper streamlining which cuts down the parasite resistance and largely does away with eddy-currants and the "boiling" of dust cloud at the funnel discharge.

The old hand operated agitators have been done away with and power agitators designed. These agitators consist of a reduction gear housed in an aluminum case with ball bearings and ball thrusts on high speed worm shaft. The high speed shaft is driven by a four-bladed propeller fan. The fan shaft is supported by a strut from the side of the plane and fitted with ball bearings. The reduction gear housing is fastened to the fuselage with tube braces. The slow speed shaft is connected direct to the agitator. The agitator rotates in the bottom of the hopper and consists of two light steel arms, fastened to each side of the shaft, which carry two small wires stretched taut at the top of these arms from one arm to the other. These wires keep the dust loose and give a minimum of friction. The old type of agitators consisted of heavy steel fingers which were oscillated on the bottom side of hopper. These gave a large account of friction and required considerable power to operate.

The old type of slide valve is still used on some hoppers and a new type of rotary valve has been developed. These valves are arranged with levers and rods to be operated by the pilot from his cockpit, thus doing away with carrying an operator in the hopper cockpit, which allows for a larger hopper.

An electrically operated automatic valve has been developed for the larger dusting planes to relieve the pilot of the necessity of keeping his hand off the control column for any length of time. All that is necessary in this type of valve is for the pilot to push a switch to open the valve and push a switch to close valve. The valve opens to the desired valve setting and stops. A low voltage generator furnishes the electric current. It is mounted on the wheel chassis and driven by an air propeller. The valve is operated by a reversible motor connected to the reduction gear, and controlled by a master switch operated by the valve gear.

Naples-Paris Non-Stop Flight

An interesting flight was recently carried out by one of the aviators in the K. L. M. Company's service, from Rotterdam to Naples and back, via London, Paris, Dijon and Marseilles. The plane used was one of the standard Fokker Jupiter F VIIA monoplanes and the total distance was covered in a flying time of 36 hr. 20 min., which included trips which were carried out in the neighborhood of Naples. The return journey included a non-stop flight from Naples to Paris in 11 hr. 35 min.

The machine was fully loaded to 7720 lb. and an average cruising speed of over 105 m.p.h. was maintained.

Throughout the whole trip the average fuel and oil consumptions were extremely good and it is worthy of note that on the non-stop flight of 11 hr. 35 min. from Naples to Paris the gasoline consumption averaged only 18 gal. per hour. This is a very fine proof of the economy of the Jupiter engine, the consumption being, approximately, 0.45 Pt./h.hp./hr. This was very largely due to the mixture corrector device which is fitted to the triplex carburetor used with the Jupiter engine. This functioned perfectly throughout and is calculated to have reduced the fuel consumption by 25%.

It may be noted that the engine used on this trip was of standard type and had already run for 450 hr. on the K.L.M. air routes. The engine was first put into service in May 1926, received its first overhaul after 215 hr. of running and was again overhauled at the completion of 418 hr. of running. At the conclusion of this trip the engine had completed in all 483 hr.

Contract Awarded for Propellers

A contract for 250 "micarta" propeller blades, made from canvas compressed into a noncorrosive product of metallic strength, has been awarded by the Department of the Navy to the Westinghouse Electric & Manufacturing Co.

Micarta is a new material, and is used in the manufacture of pulleys and fairleads required in the construction of airplanes, as well as for the manufacture of propellers. It is declared to be water resisting and moisture proof.

The micarta propeller is made principally of cotton. The process of its manufacture is a secret one, but it is commonly known that the basis of it is canvas, layers of which impregnated with certain chemical components are pressed into a substance of steel like hardness, and perfect water resistance is gained as a result of the application of the tremendous pressure exerted in the molding.

Airplane pulleys are used to guide the control wires leading from the cockpit, elevators, rudder and ailerons, while the so-called fairleads, like the pulley, serve to guide the control wire, as it prevents wear of the cable which would otherwise drag on the plane frame, cross braces and other parts of the plane.

Transcontinental Business Trip By Airplane

What is believed to be one of the first transcontinental business trips via airplane was recently made by R. W. Judson, president of the Continental Motor Corporation, accompanied by W. R. Angel, executive vice president, H. D. Kline, advertising manager of that company, and Mr. Flaherty, of Riverside, Calif., a guest. The airplane, a tri-engined Fokker monoplane, was piloted by G. R. Pond and R. N. Labadie.

They left Detroit, Mich., March 22 for the purpose of visiting dealers handling their products in the following cities: Bryan, Ohio; St. Louis and Kansas City, Mo.; Muskogee and Oklahoma City, Okla.; Amarillo, Tex.; Santa Fe, N. M.; Williams and Needles, Ariz.; Los Angeles, Calif.; Hawthorne, Nevada; San Francisco, and points on the Air Mail route from California to Detroit. After leaving Williams, Ariz., they flow through the Grand Canyon at about fifty feet below the rim. On this flight they spent 9 hr., 45 min. in the air, stopping only once for fuel.

Arriving at Los Angeles on April 12, Mr. Moreland, president, and Mr. Mallory, vice president, of the Moreland Truck Company, were taken on as passengers for the flight to Hawthorne, Nev. While flying at a low altitude over Death Valley, all the oil was lost from the three engines on account of the high temperature which prevails in this desert, forcing a landing which, fortunately, was made near a borax mine. They filled up on 600-W (a very heavy oil) and made the rest of the trip without further trouble.

The new Stearman Three-Seat OX-5 plane built by Stearman Aircraft, Inc.

Two-Way Radio Talk With Plane

Two-way radio telephony with an airplane in flight was established on May 4, when Assistant Secretary of Commerce for Aeronautics, William P. MacCracken, Jr., talked from his desk in the Department building with Dr. J. H. Dellinger of the Bureau of Standards, aloft over Bolling Field.

Assistant Secretary MacCracken spoke from his desk to the Chesapeake & Potomac Telephone Building, from which his message was relayed by radio to Dr. Dellinger in the plane. Dr. Dellinger's voice was transmitted by radio from the plane in which he was riding to a receiving set at the Department's aeronautical experimental station at College Park, Md., and the output from the receiving set was carried by telephone first to the telephone building and then to Assistant Secretary MacCracken in the Department of Commerce Building.

In order to accomplish this, the plane carried both a radio receiving and a radio sending set, according to Dr. Dellinger, and a radio receiving and a radio sending set were in operation at the College Park station. All connections were in simultaneous operation, he stated. He explained that the shifts from receiving to sending and vice versa were made in the plane itself, by the operator who accompanied Dr. Dellinger in his flight, H. Pratt, of the radio laboratory of the Bureau.

The successful conversation demonstrates, Dr. Dellinger said, that a similar conversation, through hook-up with long distance telephony, can be carried on between a plane flying above the United States and a second party anywhere in Europe.

Dr. Dellinger stated that the demonstration represented one of three radio aids to air navigation upon which the Bureau of Standards is conducting active work at the experimental field at College Park, namely, first, aid by telephony; second, aid by directive beacons; which function as aerial trolleys to keep the planes on their course; and third, aid through marker beacons, which consist of radio stations at intervals on the ground along the route to serve as "milestones."

ONE OF OUR FLYING SECRETARIES
The Hon. Edward P. Warner, Asst. Sec'y of the Navy for Aeronautics, ready for the air in the secretarial Vought UO

Increased Airplane Production During 1926

The Department of Commerce announces that, according to data collected at the census of aircraft production for the year 1926, the establishments engaged primarily in the manufacture of aircraft built 1,179 airplanes, including 54 convertible planes, valued at $8,771,077, and 7 seaplanes and flying boats, valued at $99,950, as compared with 711 airplanes, valued at $5,908,335, and 78 seaplanes and flying boats valued at $765,324, built in 1925. The total value of work done in 1926 was $24,161,752, including the value of airplane engines amounting to $4,080,571 made by establishments engaged primarily in the manufacture of such engines. The total value of products reported for 1926 by establishments in the aircraft industry propar is $20,081,181, as compared with $12,524,719 for 1925, or an increase of 60.3 per cent.

Of the 67 establishments reporting for 1926 (including 5 aircraft engine plants), 16 are located in New York, 9 in Michigan, 7 in California, 5 in Illinois, 5 in Ohio, 4 in Missouri, 4 in Pennsylvania, 3 in New Jersey, 2 in Connecticut, 2 in Kansas, 2 in Maryland, 1 in Colorado, 1 in Indiana, 1 in Iowa, 1 in Kentucky, 1 in Nebraska, 1 in Texas, 1 in Washington, and 1 in Wisconsin.

Eight Thousand Foot Parachute Jump

On April 22, Flight Lieut. David Darch Greig, of the R. A. F., was flying above Surrey Hills, when his plane developed engine trouble and began to spin. Lieutenant Greig saved himself by a parachute jump, descending 8,000 ft.

Communication Between Ground and Plane

The problem of communication between aircraft and ground troops has been the subject of experimentation and study since planes came into military use. While simple and effective communication from plane to ground has been maintained by dropped messages, that from ground to plane has not been satisfactory. Panels, radio, flares and Very Pistols have been used with varying success. Recent experiments by Cavalry troops in the Philippine Islands give promise to evolve a satisfactory method. This system requires very little special equipment and is rapid in that it involves no tedious alphabetical signal transmission, and is unmistakable since the airplane observer receives the actual map or written message as prepared by the troops on ground. This last development is known as the "pick up" system. Upon signal from the ground troops, the plane is to swoop down over the marked spot and let down from the plane an apparatus to pick up the message.

The first experimental apparatus consisted of a heavy hook or anchor made of ¾ in. iron rods welded together at their upper ends with the free ends bent outward in the form of fish hooks. This rather cumbersome anchor was then suspended from the plane by ¼ in. rope. The message was tied to the center of a length of rope, held horizontally some 6 or 8 ft. above the ground. The plane flew at right angles across the horizontal rope, entangled it in the anchor and the anchor and message were pulled into the plane.

However, further tests showed that the heavy hook and heavy rope were unnecessary. The apparatus now in use is considerably more satisfactory and less bulky. A small lead weight suspended by string, preferably carpenters chalk line, is wound on a reel on the side of the observers cockpit. The line for the ground message is of the same string formed into a large loop. The message is placed in a first aid pouch, hung to the bottom of the loop, while the upper half of the loop is stretched overhead at arms length and held between the fingers of two men, standing about 40 ft. apart. A panel is then placed to indicate to the pilot the center and direction of the loop. The observer unreels 40 or 60 ft. of the weighted line and, as the plane flies at right angles across the center of the loop, the weighted line from the plane picks up the loop and its attached message, which are then hauled into the plane.

The Aircraft Display at Bolling Field

Concluding List of Aircraft Accessory Manufacturers Who Exhibited. Analysis Reflects Wide Expansion of Industry.

THE enormous amount of aircraft and accessories exhibited at the Aircraft Display held in Washington, May 2-6, made it impossible to give a survey in one article. Brief accounts of the commodities displayed by each exhibitor have appeared in the two previous issues of AVIATION. The names of exhibitors have been listed alphabetically, and as many inserted in each issue as space allowed. In this, the concluding article, the balance of the companies which contributed to the interest and educational value of the Display are here given.

Accessories Manufacturers

(Continued)

Leece Neville Co.

Cleveland, Ohio

This company showed its voltage and charge controller and its line of generators.

Mochwhyte Company

Kenosha, Wis.

This company manufactures wire, wire rope and wire products of various kinds, specializing in high strength wires, cords and tie rods for aircraft. It displayed a line of various types of streamline wires, including the standard terminals and the Machwhyte safety lock terminal. Ordinary round swaged wires were also shown.

E. B. Meyrowitz, Inc.

New York City

Since the War, this company has been identified with the manufacture of goggles for the use of fliers. Its exhibit embraced a complete display of the various types of goggles manufactured, together with an interesting collection of photographs of aviation activities.

National Air Transport, Inc.

Chicago, Ill.

The National Air Transport, Inc., which operates the air mail service between Chicago, Ill. and Dallas, Tex., and who has been awarded the contract for the carrying of mail between Chicago and New York City, had at its exhibit a map of the air mail route it operates, photographs of operating activities and a model of the Curtiss Carrier Pigeon airplane, which is largely used by this company. Air mail stamps and envelopes were sold at this booth to encourage visitors to use the air mail in sending greetings to their friends.

National Steel Products Company

Dayton, Ohio.

A complete collection of aircraft fittings and other metal products, manufactured by this company, were on display, including engine control assemblies, hand gasoline pumps, rudder bars and supports, radiator filler assemblies and similar parts.

Claude Neon Lights

New York City.

Neon tubes not in operation and also some in use were exhibited at this stand. The tubes shown in operation included spirals in blue and orange and a miniature beacon about five feet high, somewhat after the type of that installed for National Air Transport, Inc., at Moline, Ill. This type of light is stated by the Claude Neon firm to be coming into quite general use in England and Germany for beacon use. The Neon tube operates on an alternating current of about 8,000 to 10,000 volts. The blue tint is obtained by filling the exhausted tube with a small amount of Neon gas alone. This company claims the chief advantage of Neon tubes for beacon purposes is the high visibility which they provide in a fog, because of the distinctive color of the light. The tubes radiate very little heat, provide almost a cold light and the life of a tube is reported to be about 6,000 hr.

Norma-Hoffman Bearings Corporation

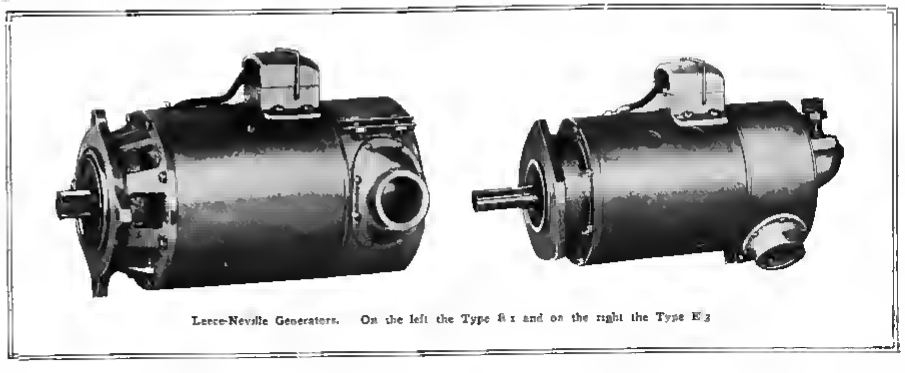
Stamford, Conn.

This company demonstrated the efficiency of its roller bearings by the use of a fly wheel mounted on Norma-Hoffman bearings. Evidence of the silence and anti-friction properties of the product were conclusive, the fly wheel turning with so little friction that it seemed to run indefinitely when started by a slight pressure of the hand. Various sizes of roller bearings were also exhibited.

Payne Export and Import Co., Inc.

New York City.

Plywood, aircraft propellers, Rome-Turney radiators, new Curtiss OXX-5 engines, Vimalert modernized Liberty engines, Penuzoil products and many other aeronautical materials were exhibited by this company, which handles a wide line of aircraft equipment for export and also acts as purchasing agents for foreign governments in the American aeronautical market.

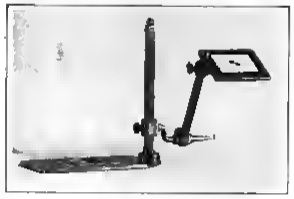


Leece-Neville Generators. On the left the Type B 1 and on the right the Type E 2

Pioneer Instrument Company

Brooklyn, N. Y.

A company whose products have so long been a necessary adjunct to safe flying and whose name has been identified with most flights and records of recent years might be expected to contribute an important section to the Display, and the extensive line of instruments which the Pioneer Instrument Company placed on view more than out. A large instrument board was exhibited carrying numerous types and an earth inductor compass was on demonstration at the booth. Magnetic compasses, running lights, airplane landing lights, Wiley parachute flares and holders and the Wiley signal discharger were shown. The Wiley signal discharger is a new development intended to replace the Very pistol and consists of a cartridge carrier with a quick release device combined with the firing mechanism. When operated by the pilot, the cartridge is ignited and released simultaneously so that it drops clear of the airplane and eliminates fire hazard. Red, green and white cartridges are marketed for the holder.



The Fairchild Aerial View Indicator

Pioneer altimeters were displayed in the edgewise type with rotating dial. Edgewise climb indicators, fuel gauge thermometers and oil pressure gauges, with fixed dials and moving hands, were a part of the exhibit. The dial consists of a quadrant set edgewise in the instrument board. The company displayed in the hangar and frequently in flight its "flying showcase", a Travel Air biplane used for instrument demonstration, which carries practically every type of airplane instrument used, most of them being in duplicate, one for flying purposes and the other for demonstration.

John A. Roebling's Sons Company

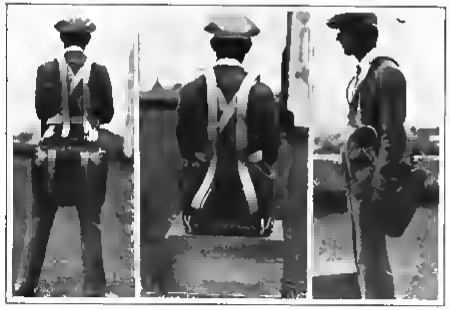
Trenton, N. J.

This company displayed a board showing its various types of wire products for aircraft use.

Russell Manufacturing Co.

Middletown, Conn.

Samples of shock absorber loops manufactured by the Russell Manufacturing Co., were shown, as well as straight shock absorber cord, brake linings, clutch facings and numerous types of webbing and belts.



The Russell Parachute

Russell Parachute Co.

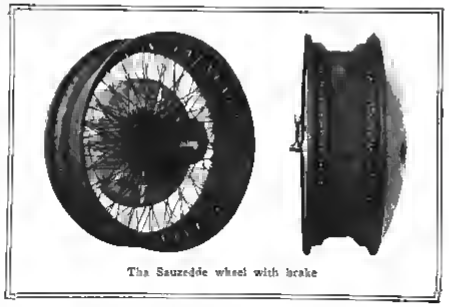
San Diego, Cal.

The pack type of parachute and photographs of the Russell parachute in operation formed this portion of the Display.

Sauzedde Corporation

Detroit, Mich.

Wheels of special design, fitted with brakes, in the various sizes manufactured by the Sauzedde Corporation were placed on display at the company's section. The Sauzedde brake was the first applied to airplanes in actual practice and the Sauzedde wheel differs considerably from the conventional airplane wheel, having three rows of spokes and all the spokes being of equal length with the same angularity.



The Sauzedde wheel with brake

Scintilla Magneto Co.

Sidney, N. Y.

Although the Scintilla Magneto Co. maintained no separate booth, it exhibited its product in connection with the display of Wright engines. The Scintilla magneto is based on a new principal of design and construction, the permanent magnets being of the rotating type. The contact breaker and the armature are stationary. Scintilla magnetos are in use on many engines of American manufacture.

SKF Industries, Inc.

New York City

This company manufactures numerous types of ball bearings and besides exhibiting these items, showed their application to aircraft engine crankshafts on Pratt & Whitney, Packard 1-A-1500 and Wright Whirlwind engines. A Fairchild-Caminez piston was exhibited, showing the SKF mounted roller and a Sperry beacon was shown in which SKF bearings are used. The corner posts of the booth carried two large bearings of the SKF ball and roller types, which indicated very clearly the self-aligning feature.

Sperry Gyroscope Company

Brooklyn, N. Y.

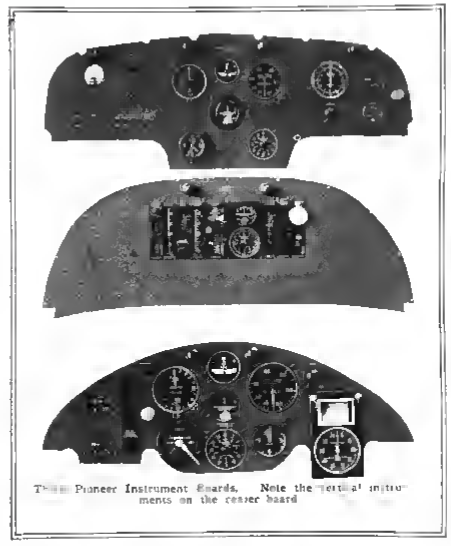
Of recent years, the Sperry Gyroscope Company, has, in addition to its activities, specialized in the manufacture of equipment for the lighting of airports, and the high degree of success that has been attained was demonstrated in the specimen products displayed. A motor driven revolving incandescent electric beacon and a 36 in. portable landing light, using a 10 kw. incandescent electric lamp were shown. The beacon is mounted on a truck with Ford automobile wheels to facilitate transportation. In addition to the display in the hangar, a large portable floodlight was in operation on the field, in connection with the night flying demonstration.

The Russell Parachute in use

Splitdorf Electric Co.

Newark, N. J.

Visitors to this booth were shown various types of magnetos, of this company's manufacture, including the new double armature vertical model. Special socket wrench kits made by the Splitdorf-Bethlehem Electric Co., of Bethlehem, Pa., were also shown here.



The Pioneer Instrument Boards. Note the vertical instruments on the center board

Standard Steel Propeller Co.

Pittsburgh, Pa.

The company had several of its two and three blade aircraft propellers, using the split type hub and forged duralumin blades, on exhibition.

A. G. Spalding & Bro.

New York City

This well-known sporting goods manufacturer displayed a complete line of aviation clothing, including suits, helmets, leather jackets and similar articles, as well as oxygen helmets and other special equipment. The line of suits filled the rear of clothes hangars lining the rear of the booth and gave the Display the appearance of a well-stocked clothing salesroom.

W. Harris Thurston

New York City

This company had bolts of balloon cloth and airplane cotton, in addition to various types of aircraft tapes on view. Doped panels of airplane fabric were also included. This company manufactures the well-known Dartmouth-Tex aero cloth.

Vacuum Oil Company

New York City

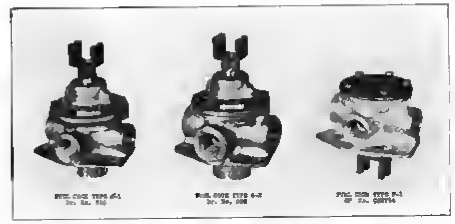
The Vacuum Oil Company displayed samples of its oil and the cans in which these are distributed for consumption in small quantities.

Commander Byrd using an Alcraft made by Airships, Inc.

Vellumoid Company

Boston, Mass.

The product manufactured by this company is an oiled paper composition packing material. It displayed its product cut in the shape of gaskets for various uses, such as packing between cylinders and crankcases, packing for cylinder, gem blocks etc. In order to demonstrate the strength of this material a piece of Vellumoid, cut in a narrow strip, was suspended in the booth, with a heavy iron ball attached.



Fuel Cocks manufactured by the National Steel Products Co.

Reproducibility of Penetration

Report No. 258, covering "Some Factors Affecting the Reproducibility of Penetration and the Cut Off of Oil Sprays for Fuel Injection Engines", compiled by E. G. Beardsley, was undertaken at the Langley Memorial Aeronautical Laboratory of the National Advisory Committee for Aeronautics, in connection with a general research on fuel-injector engines for aircraft. The purpose of the investigation was to determine the factors controlling the reproducibility of spray penetration and secondary discharges after cut-off.

The development of single sprays from automatic injection valves was recorded by means of special high-speed photographic apparatus capable of taking 25 consecutive pictures of the moving spray at a rate of 4,000 per second. The effects of two types of injection valves, injection-valve tube length, initial pressure in the injection-valve tube, speed of the injection control mechanism, and time of spray cut-off, on the reproducibility of spray penetration, and on secondary discharges were investigated.

It was found that neither type of injection valve materially affected spray reproducibility. The initial pressure in the injection-valve tube controlled the reproducibility of spray penetrations. An increase in the initial pressure or in the length of the injection-valve tube slightly increased the spray penetration within the limits of this investigation. The speed of the injection control mechanism did not affect the penetration.

Analysis of the results indicates that secondary discharges were caused in this apparatus by pressure waves initiated by the rapid opening of the cut off valve. The secondary discharges were eliminated in this investigation by increasing the length of the injection valve tube.

Report No. 258 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

English Air Meet at Bournemouth

At the best a handicap race is unsatisfactory. Such a race is dependent entirely upon arbitrary, man-made decisions. In the past the preponderance of events at air meets were between planes of widely differing power and characteristics. Such being the case handicap events only were possible. But the English magazine "Flight" sees in the Easter week-end meet held at Bournemouth, England, a tendency toward what can be compared to "one design" racing as has been practised in yachting.

In this meet there were twenty-eight individual planes entered. Of this number nine or ten were Moths, produced by the deHavilland Aircraft Company. This is the type of plane owned by all of the English Government—subsidized lightplane clubs and several of the entries were the planes of these clubs. All of these Moths were not exactly in the same class because there was a difference in the power plants that they carried. Some of them had the Cirrus Mark II engine, while others had the Cirrus Mark I engine. The former is a new engine and more powerful than the older model Cirrus. But even with this difference there was more similarity between the planes in the meet than is usually the case. As a consequence there were several "scratch events." These events tend to be more interesting since the outcome of the race is dependent largely upon the skill of the pilot in flying a good course, cornering, flying high or low according to the wind direction, etc.

All together there were twenty-one events for which there were one hundred-and fifty three entries, planes being entered for more than one event. Besides the deHavilland Moths, previously mentioned, there were three Avro Avians fitted with Cirrus Mark II engines; two Westland Widgeons, one with a Genet engine and another with a Cirrus Mark II engine, (the latter was one of the fastest planes at the meet) and some lightplanes such as the Hawker Cygnet, Bristol Browne, Blackburn Bluebird, and others. One of the new planes at the meet was the Avro-Lynx, powered with an Armstrong—Siddeley Lynx engine. The new machine has "K" struts and a biconvex wing section, in which the center of pressure is constant.

The meet was held over the Easter week end and was well attended. The weather was good especially during the latter part of the meet. During the entire meet there was a clock-like smoothness in the way that events ran off.

Gunning airplanes with a shot gun is a new sport that is just starting in England! Squadron-Leader Lonton was flying his Blackburn Bluebird to the Easter air meeting at Bournemouth, and was flying low over some rural district when a farmer took a shot at him with a shot gun. Fortunately neither the pilot nor the plane was hurt but this certainly was no fault of the man with the gun, as the plane was literally riddled with holes.

Beacon Towers at La Jolla, Cal.

Four self-supporting steel beacon towers, each provided at the top with an 8 ft. diameter target, have been completed north of La Jolla, Cal. Towers T1 and T3 are located near the paved highway (Coast Route) leading to Los Angeles, the two remaining towers are located on top of the bluff approximately one-fifth mile eastward from the beach line. The height and location of each tower are as follows —

Latitude	32°	52′	35″	N	Tower T1
Longitude	117°	14′	27″	W	Height 40 feet
Latitude	32°	53′	35″	N	Tower T2
Longitude	117°	14′	58″	W	Height 115 feet
Latitude	32°	54′	35″	N	Tower T3
Longitude	117°	14′	40″	W	Height 45 feet
Latitude	32°	54′	35″	N	Tower T4
Longitude	117°	15′	08″	W	Height 115 feet

Due to the fact that these towers are located in the main air lane between San Diego and Los Angeles, it is considered advisable that all pilots be informed of their location in order to obviate possibility of collision during foggy weather.

Acme Photo

WHAT A BRITISH AIR MEET LOOKS LIKE. A general view of Ensburg Park Race Course, Bournemouth, England during the recent air meet held there. The planes in the air are DH Moths (Cirrus, 75 hp.) while the machine on the ground is the Imperial Airways Handley Page airliner with three Jupiter air-cooled engines.

Foreign Aeronautical News Notes

By Special Arrangement with the Automotive and Transportation Divisions, Bureau of Foreign and Domestic Commerce

Seville-Buenos Aires Airship Service

La Colon Transaerea, a company authorized to operate an air service between Seville and Buenos Aires, has been founded with a capital of approximately $170,000, distributed in 1,000 shares of $170 each. Half of this has been distributed among the founders of the company in free shares.

In addition to the 1,000 shares of initial capital, 1,000 shares are created for founder shareholders. Each new emission of shares shall be accompanied by founders' shares of a nominal value of 20 per cent of those emitted. In case the company is dissolved, the holders of founders' shares will have the character of creditors with the right to reimbursement. Ten per cent of the profits shall go to a reserve fund, and 10 per cent to the Board of Directors. Share holders shall receive dividends of 5 per cent. Other profits, if any, shall be distributed equally between founder and ordinary shareholders.

The Companin Zeppelin, which is united with the Transaerea Co., for the establishment and exploitation of the line, shall receive a trial dirigible of 30,000 cubic meters valued at $318,750, $85,000 in cash and a fixed dividend, for the installation of the traffic service and instruction base at Seville. The Zeppelin Co. shall be responsible for the management and technical organization of the trans-Atlantic air service between Spain and Argentina, and shall receive $85,000 cash 33 1/3 per cent of the first year's profits, and 3 1/3 less each year until their share becomes 10 per cent. This company shall also be allotted one-third of the total capital to be held throughout the time of the contract in return for its construction of terminal facilities. The dirigibles will be bought from the Colon Transaerea, builders, at cost price plus 20 per cent in cash, or 10 per cent in cash and 20 per cent in ordinary or founders' shares in any one of the three above mentioned enterprises.

Airport at Schkeuditz

Work on the Central German Airport being built at Schkeuditz between Leipzig and Halla, near Leipzig, progressed during the last quarter of 1926. The Schkeuditz field is to serve as a port for the main lines, which are subsidized by the central Government and connect with the international air routes. It is planned to inaugurate shorter local lines connecting Schkeuditz with all the more important cities of central Germany.

Polish Budget for 1927-28

In Poland's civil aviation budget for 1927-28 there is granted an appropriation of $737,100 of which $612,360 will be distributed among the various air lines as a subsidy based on flight mileage. Last year, the Polish Ministry of Communications had only $442,260 to spend for civil aviation purposes.

Air Shopping Tours

One day shopping excursions from Croydon, London, to Paris, will be operated by the Imperial Airways. The planes will leave Croydon at 7:15 a.m. and passengers will have about seven hours in Paris before returning from Le Bourget at 6:30 p.m., and it is anticipated that the service should prove a popular one. Should it achieve a substantial measure of success, a corresponding service may be instituted, operating from Paris and giving the day in London. This would be an advantage to business men.

Aviation Makes Progress in Australia

The number of trained airmen in Australia is increasing rapidly and plans looking to development of training facilities are progressing.

In addition to the pilots being turned out continuously by the flying clubs, arrangements have been made with private organizations, such as the Quantas and Western Airways companies to train pilots in schools established in local centers. Seven schools of this type are reported to be in operation at the present time and there are approximately 350 new pilots being trained each year in these training centers.

Among the most important aviation developments foreshadowed in Australia are: the opening of the transcontinental mail service from Perth to Adelaide; the opening of the service connecting Tasmania with the mainland; the establishment of a route to Normanton, Gulf of Carpentaria, in the heart of the cattle country, and from Cloncurry to the Burkly Tableland; extension of the Quantas service beyond Camooweal, extension of the Western Airway to Wyndham, via Halls Creek; establishment of a service from Brisbane to Toowoomba, Warrick and Wallangarra, and the opening of the Sydney-Canberra-Melbourne route. All of these are now services and by the end of the year, each of them is expected to be in full operation.

With the completion of these lines the entire continent, with the exception of a short gap in the Northern Territory, will be encircled by air services, and it is practically certain that the gap will be closed in the near future.

New Mexican Air Service

A concession to establish a freight and passenger air service between Mexico City, Pachua, Tampico and Matamoras has been secured by a company headed by J. Lezama from the Ministry of Communications and Public Works. The company's representatives are said to be selecting the landing fields and preparing them for this service.

Hamburg Aviation Activities

Statistics of Hamburg, Germany, aviation activities during 1926 show that there were 10,441 airplane flights, of which 4,957 were long distance scheduled flights, 1,036 were non-scheduled long distance, and 4,448 were local flights. During the year 14,218 passengers were carried on scheduled flights, 1,221 on non-scheduled and 3,285 on local flights.

Deutsche Luft Hansa Shows Progress

Results of the Deutsche Lufthansa for 1926 show increases in all forms of traffic over the previous year. The length of lines increased to 32,842 mi., while the length of lines for the winter service, introduced for the first time in the middle of October, amounts to 13,119 mi. During the year 9,883,482 air mi. were covered, which is an increase of 24 per cent compared with 1925. The number of passengers conveyed increased by 50.3 per cent to 56,268 persons. The conveyance of luggage and freight amounted to about 1,376,943 lb. which is approximately 115 per cent more than in the preceding year. Air mail totaled nearly 302 tons, indicating an increase of 86.4 per cent as compared with 1925. Especially the night line Berlin-Koenigsberg has been greatly made use of for the transportation of mail. The regularity of the Summer service reached 90 per cent, however, on several lines a full regularity was attained.

Side Slips

By ROBERT R OSBORN

The successful New York-to-Paris flight proves conclusively we claim, that well-wishes can help along an airplane as well as they can a man We would think it perfectly safe to offer an additional $25,000 for proof that there was a single person in the United States who was not wishing the best of luck to the lucky Captain The Department of Commerce hasn't given out any figures covering the flight yet, but our own experts have estimated that, during the two days that the flight was in progress, there were 400,000,000 conversations ending with "I hope he makes it." Certainly every one who came in contact with him in any degree, immediately became a well wisher, not only for the sheer courage of the enterprise, but for the man himself

Of course we are going to be accused of conspicuous osculation in this case, but we are willing to risk that to put our own congratulations to "an officer and a gentleman" on paper

"Captain Lindbergh! Gentlemen, shall we rise?"

• • • •

The Intrepid Aviator claims he didn't expect any difficulty on the flier's part in keeping awake for thirty-four hours or more, as he himself had frequently sat through poker games which lasted longer than that. The lack of sleep didn't bother his flying ability either, he claims, as he often had to go out to take up a couple of passengers to get enough capital to continue with the game

• • • •

One real hazard connected with the flight that no one seems to appreciate, was that there were some fifteen gas cocks in the net-work in front of the flier, each one identical with the rest. We could name one famous aviator who has difficulty in controlling a single gas valve, having made several forced landings with a full reserve tank If he had been making the trip we fear he would have run out of gas somewhere near Port Jefferson, L I.

• • • •

Whenever the tests were under way at Curtiss Field for the flight, several women were sure to run out of the crowd, shake hands with Captain Lindbergh, and,—"God bless you, my boy I have a son at home like you." After he landed one time no one came near him for some reason, all standing at a good distance from the plane. After about a minute of this, "Merry" Merrill, manager of the Curtiss Flying Service, came breaking his way through the crowd, ran over to Lindbergh and shaking his hand heartily said, "God bless you my boy I have a son at home like you." Needless to say, the meeting broke up in a riot.

• • • •

The newspapers seemed to have hundreds of reporters on hand at all times, ready to gobble up anything that might be made into news. The newspapers seemed to enjoy the troubles that arose during the preparations more than they did the progress when plans were proceeding smoothly. Once, when Captain Lindbergh was undecided about certain supplies to take along, we expected to see black headlines the next day—

"Dissension Disrupts Crew of Spirit of St. Louis"

• • • •

Another very satisfactory condition arising from the flight is that it is conclusive proof that some one is making money out of "this airplane business" Of course, a few thousand people are making good money out of the business but none of them will ever admit it. Captain Lindbergh is in the unfortunate position that he has to admit he has made at least $25 000.

AIRPORTS AND AIRWAYS

Casper, Wyo.

Casper has two organizations to further the interests of aviation, both as a sport and as a commercial proposition. The business matters are looked after by the Wyoming Airways Corporation, the officers of which are Walter Storrie, president; R. Lefernk, vice-president and chief pilot; D. P. Wardwell, secretary and general manager; J. E. Davis, treasurer; and E. C. Delgarde, director. Aviation as a sport in Wyoming is being developed by the Powder River Flying Club, the officers of which are D. P. Wardwell, president; Burke H. Sinclair, first vice-president; Walter Storrie, second vice-president; J. E. Davis, secretary; and Lee Townsend, treasurer. B. G. Westover, of Kemmerer; R. L. Copsey, of Thermopolis; E. C. Delgarde, R. Leferink, R. H. Nichols and George Jarvis are directors.

The Powder River Flying Club formally opened its new club house on May 8. Lieut. Russell Maughan, of the Army Air Service, and of Dawn-to-Dusk Flight fame, J. Don Alexander, president of the Alexander Aircraft Corporation, C. P. Clevenger, and six members of the Colorado National Guard came to Casper for the dedication ceremonies.

Addresses were made by Lieutenant Maughan, former Governor B. B. Brooks, Congressman Charles E. Winter, Mayor John T. Scott and Major D. P. Wardwell. A review of headquarters troop, 58th Cavalry Brigade, Wyoming-Idaho National Guard, and an aerial parade and stunts, were features of the program.

There are about twenty-six pilots located in Casper and as many more within a radius of an auto trip of one day from the city. At present the club has approximately 120 members of all classifications, fliers and non-fliers both resident and non-resident. The club planes make frequent and regular visits to other cities in Wyoming where members reside. A Standard J-1, with 180 hp. Hisso engine, is owned by the club and when funds are available, an Eaglerock will be purchased for the training of advanced students and the use of club members in general.

At present the Wyoming Airways Corporation has ten students enrolled in the primary training class. The course includes both ground school work and flight training.

Flint, Mich.

By Ralph Brockway

For the first time in its history the city has two flying fields in operation. The new field is the Dixie Airport established by the Dixie Flyers, C. W. Maris and G. W. Francis. It is located one mile south of the city limits on the Dixie Highway thus being about fifteen minutes from downtown by automobile.

The field is large and permits of long take offs in north-south and east-west directions, the latter and best being with the prevailing winds. There are several trees on the field but these are so situated as to be of little interference.

There is a gasoline station adjacent to the main entrance and gasoline and oil may be had on the field at all times by means of a portable tank with pump and hose. Another convenience is the lunch counter also at the main entrance, which saves the pilots from wasting much time in driving back and forth to the city for their meals.

The field has four entrances and from the business done in the week of operation thus far, there is little doubt but what the Dixie Flyers will be in the air constantly during fair weather.

The equipment of the Dixie Flyers at present consists of one new Waco Nine, the property of Mr. Francis. Mr. Maris is waiting impatiently for his Waco Ten, now on order.

Santa Ana, Cal.

By Jack Colvin

The Santa Ana Air Club recently celebrated its first year of existence with a membership list of about eighty persons. The list is made up of young and old from all walks of life but all with an interest in aviation.

The club has staged some very successful meets and recently put on a model contest in which both scale and flying models contended for the three silver cups and merchandise prizes which the Club offered. Members are looking forward now to the completion of a club house. The club has a library consisting of about $60 worth of technical books and there is $200 in the treasury. The purpose of the Club is to promote aviation and we are out to put Santa Ana on the air map.

UNITED STATES AIR FORCES

Captive Balloon as Target

A captive balloon was inflated and placed northwest of the Airship Hangar, Langley Field, Va., at 1500 ft. altitude as a target for pursuit training in the attack of an observation balloon. This aerial gunnery was held by the students of the Air Corps Tactical School, and thirteen pursuit planes, including SE-5's, AT-4's and P-1's were used in this attack. After a few minutes maneuvering over the balloon, the real attack was started and the balloon was shot down by the third passing plane.

Air Maneuvers at Kelly Field

Dwight F. Davis, Secretary of War, arrived at Kelly Field on May 18 in a Fokker transport, which he boarded at Austin, Tex. He was met at Kelly Field by an escort of fourteen planes. Among those who welcomed him were F. Trubee Davison, Assistant Secretary of War for Aviation, Major Gen. Ernest Hinds, commanding the maneuvers, and Major Gen. Mason M. Patrick, Chief of the Air Corps.

Austin, capital of the imaginary country which was "at war" with an imaginary nation, whose capital city was San Antonio, was attacked from the air May 16 by six bombardment planes from Brooks Field, which dropped hypothetical bombs on the capitol grounds and a railway bridge near the city. The planes left their station at 8 p.m. and returned two hours later. They were in radio communication with the commanders of the Blue Army, which was defending San Antonio and the country to the south.

The night bombardment was the principal feature of the first day of the battle between the Blues and the Reds, who were encamped on the Cibolo River, twenty miles north of San Antonio. The blue air brigade, in command of Brig. Gen. James E. Fechet, had all its branches working. At 5 31 a.m., the first pursuit group, numbering twenty-four planes, flew to the enemy airdrome at New Braunfels. Six imaginary enemy pursuit planes were sighted on the ground in front of the hangars by the Blue pilots, and they were destroyed with 17 lb. bombs. Anti-aircraft fire brought down

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one Blue plane Bombardment and attack groups bombed and machine-gunned Red troops, near Fredericksburg Junction, and one bombing plane was lost

The combined ground and air maneuvers came to an end on May 19, the victory going to the Blue Army, which successfully defended San Antonio from the advance of Red forces from the north Officers of both ground and air forces expressed entire satisfaction at the success of the maneuvers.

Changes in Station of Air Corps Personnel

The coming Summer will see many changes in station of Army Air Corps personnel, this being occasioned by the definite steps taken to carry into effect the first increment of the five year expansion program of the Army Air Corps, embodied in the Air Corps Act approved July 2, 1926

The establishment of an additional Primary Flying School at March Field, Riverside, Cal, has made it necessary to effect a change of scenery for nine Squadrons and two photo sections Orders have already been issued by the War Department for the movement of the 11th Bombardment Squadron from Langley Field to March Field This organization will sail from Norfolk, Va, on transport leaving May 18

Other organizations slated to go to March Field along about the middle of June are:

95th Pursuit Squadron	from	Selfridge Field Mt. Clemens Mich.
70th Service Squadron	"	Kelly Field, San Antonio Tex.
44th Observation Squadron	"	Post Field Fort Sill, Okla
23rd Photo Section		Post Field Fort Sill Okla
47th School Squadron	"	Brooks Field San Antonio, Tex

It is expected that the 95th Pursuit Squadron and the 44th Observation Squadron will be made inactive shortly after arrival at March Field and become the 53rd School Squadron and Headquarters 13th Pursuit Group

The 15th Observation Squadron, stationed at Chanute Field, Rantoul, Ill., for a number of years, will proceed to Kelly Field for station on or about June 20th It is expected that this organization will be made inactive shortly after arrival at its new station and become the 48th School Squadron

The 99th Observation Squadron from Bolling Field, D C, is scheduled to go to Kelly Field, Tex, on or about June 20th

The 88th Observation Squadron, stationed at Wright Field, Fairfield, Ohio, left for Brooks Field Tex., its new station, on May 4.

Brooks Field will be the new home of the 50th Observation Squadron and the 20th Photo Section from Langley Field, Va., on or about June 22. It is contemplated placing the 50th Observation Squadron on inactive status, the members thereof to be assigned to the 52nd School Squadron

The enlisted men of the various organizations listed above will proceed to the stations specified in their authorized grades and ratings

Army Air Orders

First Lieuts John Y York, jr Washington and Henry G Woodward, Chanute Field to Cambridge Mass to take course in the Graduate School of Business Admin Harvard University

Sec Lieut Gerald Pomeroy Young Air Corps Res, Dayton Ohio, to active duty Edgewood Md reverting to inactive status June 16

First Lieut. Birnie L Brunson Air Corps (Fin Dept.) 2nd Div Fort Sam Houston relieved from detail in Air Corps and will report to the com gen Eighth Corps Area at the foregoing station

Sec Lieut. William W O'Connor Air Corps (Inf) relieved from detail in Air Corps 2nd Div Fort Sam Houston and will report to com gen. of that division

Sec Lieut Benjamin W Chidlaw promoted to rank of first lieutenant

The following officers of the Air Corps are relieved from assignment and duty at the place specified and are assigned to duty at March Field. They will proceed to Brooks Field and report for temporary duty for the purpose of pursuing a special course of instruction They will report not later than Sept 15 for duty at March Field Capt Byrne V Baucom, First Lieut. John S Gullet Sec Lieut George L Murray Bolling Field; First Lieut. Frederick Von H Kimble Selfridge Field First Lieut Aubrey Hornsby Maxwell Field First Lieut. Paul L Williams Sec. Lieuts, Patrick W Timberlake Dixon M. Allison Wallace S Dawson Langley Field First Lieut. Earl S Hoag office Chief Air Corps Washington; First Lieut Charles McK Robinson Sec Lieuts Hoyt S Vandenberg, Edgar T Noyes Earl W Barnes, Fort Crockett First Lieut Arthur L McCullough Sec Lieut Walter C White Mitchel Field First Lieut James M Bevans Sec Lieut Ralph E Fisher Fort Riley Sec Lieuts James Hewins jr and John H Dulligan, Aberdeen Md Sec. Lieut. George F Henry Crissy Field

The following officers of the Air Corps are relieved from assignment and duty at the place specified, and will proceed to Brooks Field First Lieuts Robert D Knapp Oscar L Rogers Sec Lieuts Joseph C A Denniston Claire Stroh and Arthur I Lehman Maxwell Field First Lieut. Alfred E Waller Middletown First Lieut Edmund C Langmead, Sec Lieut. Harvey R Ogden Fort Sam Houston First Lieut Donald F Fritch

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(F A.), Sec. Lieuts Albert F Glenn, Thomas J Holmes, Mitchel Field. Sec. Lieuts James W. Spry, Robert W. Harper, William E Baker (Inf.), John F Guillett, Fort Crockett. Sec. Lieuts James R. Hawkins, Alva L. Harvey, Elmer J Rogers, jr, Bernard A. Bridget, John T Sprague, Langley Field. Sec. Lieuts Lawrence C Elliott, Clifford P Bradley, Charles H Deerwester, Selfridge Field. Sec. Lieut. Glenn L. Devenier, Fort Sill, Sec Lieut Walter C Bryte, jr, Crissy Field Sec Lieuts Russell E Randall, Harvey F Dyer, Fort Riley Sec. Lieut Francis E Cheslie Wright Field, Sec Lieut. Signe A Gilkey Chanute Field.

The following officers of the Air Corps are relieved from assignment and duty at the place specified after his name and will proceed to Kelly Field: First Lieut. Arthur Thomas and Sec Lieut Otto P Weyland, Fort Sam Houston First Lieut. Donald G Stitt, Fort Sill First Lieuts Floyd A Lundell Ralph F Stearley (Cav), Fort Crockett First Lieut Jasper K. McDuffie Mitchel Field First Lieut Frank L Cook Middletown: First Lieuts Harold A Moore John R Glascock, Crissy Field First Lieut. Arthur G Liggett Sec. Lieuts Carl J Crane, Leonard H Rodieck Lee Gehlbach and Clarence S Irvine Selfridge Field First Lieuts. Harry F Colliver, Thad. V Foster, Sec Lieuts Thomas L Lowe and Elmer T Rundquist, Langley Field. First Lieut. Alfred L Jewett, Fort Riley: First Lieut Clarence P Talbot, Wright Field Sec Lieut. William D Old Maxwell Field

First Lieut Gervais W Trichel, Air Corps (Coast Art. Corps), relieved from duty with 2nd Div., detail with Air Corps, and station at Fort Sam Houston and is assigned to 51st Coast Art., Fort Monroe

First Lieut Edward L. Fernstee, Air Corps, Brooks Field, to Fort Sam Houston

Sec Lieut Donald Dunford Air Corps (Inf) relieved from detail in the Air Corps from duty with 2nd Div and station at Fort Sam Houston He is assigned to 17th Inf, Fort Omaha

Major Shepler W Fitz Gerald, Washington, to Brooks Field

Sec. Lieut. Robert E Martin Air Corps (Inf) is relieved from duty with 2nd Div., detail in Air Corps and station at Fort Sam Houston He is assigned to the 17th Inf. Fort Des Moines

Sec Lieut Henry L. Hughes, Air Corps, Kelly Field, to Fort Sam Houston

First Lieut Courtland M. Brown, Air Corps is assigned to duty at Brooks Field upon completion of his present tour of foreign service

Lieut. Col Ira F Fravel Air Corps, Washington Barracks D C, to Middletown

Capt John T Murray Air Corps (Inf) is relieved from detail in Air Corps. He is relieved from present assignment at Fort Sam Houston and is assigned to the Inf 2nd Div, that station

First Lieut John F Fehlike Air Corps (Inf) is relieved from detail in Air Corps from duty with 2nd Div and station at Fort Sam Houston and is assigned to the 25th Inf with station at Douglas Ariz.

First Lieut Russell C Winchester Air Corps (Cav) is relieved from detail in Air Corps duty with 2nd Div., and station at Fort Sam Houston. He is assigned to the 3rd Cav. with station at Fort Ethan Allen

Sec Lieut Dalrre J Oyster Air Corps (Field Art) is relieved from detail in Air Corps from duty with 2nd Div., and from station at Fort Sam Houston and is assigned to 18th Field Art Fort Sill

Capt Richard B Wills Air Corps (Field Art) is relieved from detail with Air Corps and from present duties at Fort Sam Houston and is assigned to the Field Art 2nd Div at that station

Capt John W Thompson, Air Corps (Inf.) is relieved from detail in Air Corps and from present duties at Fort Sam Houston, and is assigned to the Inf of 2nd Div., at that station

Capt Ralph L Love Air Corps (Inf) is relieved from detail in Air Corps and from present duties at Fort Sam Houston and is assigned to Inf of 2nd Div., at that station

Capt James P Lynn, Air Corps (Inf) is relieved from detail in the Air Corps and from duty with 2nd Div at Fort Sam Houston. He is assigned to the 24 Inf with station at Fort Benning

First Lieut. Roy P Huff, Air Corps (Field Art.) is relieved from detail in Air Corps and from present duties at Fort Sam Houston. He is assigned to the Field Art. 2nd Div., at that station

Sec Lieut Ransom G Amlong, Air Corps (Quarter Corps) is relieved from detail in Air Corps and from assignment and station Brooks Field He is assigned to the Nrrmoyle quart. int. drp. Camp Normoyle

First Lieut Addison Garland Person, Air Corps Res Washington, to active duty Selfridge Field reverting to inactive status June 30

First Lieut Harold A. Willis Air Corps (Ord Dept) is relieved from detail in Air Corps and from duty with 2nd Div Fort Sam Houston He will proceed to La Crosse Ohio and report to com. off Erie ord res. dep., for temp duty Upon completion of temp. duty he will proceed to Savanna Ill, and report to com. off ord. res dep for duty

Navy Air Orders

Lieut Guy D Townsend det. Nav Aircf. Fact., Navy Yard, Phila, to VT Squad 1 Aircf Squad Setg Fleet

Capt John D Manchester det. Bu M & S to Nav Air Sta, San Diego SHRDLU CMFWYP VBGKQJ CMFWY

Lieut (jg) Winfred P Dana det VS Squad 1 Aircf Squad, Setg Fleet to VT Squad 1 Setg Fleet

Lieut. (jg) Clifton A. Young det VT Squad 1 Aircf Squad. Setg Fleet to VS Squad 1 Aircf Squad., Setg Fleet.

Comdr George S Reals det. USS Wright to Nav Air Sta, Pensacola

Lieut, (jg) Earl M. Criger det. USS Memphis, to Nav Air Sta Lakehurst.

Lieut. Comdr Harry R Hogaboom det. Nav Air Sta., Pensacola to Nav Air Sta San Diego

Lieut Lester T Hundt det Bu Aero, to Obs Plane Squad 8 Aircf Squad Setg Fleet

Lieut. John Stanley det Nav Air Sta., Nav Oper Base Hampton Roads to USS New York

Lieut (jg) James B Vail det VJ Squad. 2, Aircf Squad, Setg Fleet to Nav Air Sta, Pensacola

Ens Frederick N Kivette det. USS Idaho, to temp duty Nav Air Sta, Pensacola

Lieut Raymond Tyler det. USS Los Angeles, to Nav Air Sta., Lakehurst

Ens Aubrey G Lanston det USS Texas, to temp. duty Nav Air Sta, Pensacola

Ens Robert W Larson det USS Rochester, to temp. duty Nav Air Sta., Pensacola

Lieut Eugene F Burkett det. Nav Air Sta Pensacola to Hydrographic Off Navy Dept

PUBLISHER'S NEWS LETTER

When these lines are read the greatest flight in the history of aeronautics will have been discussed from so many points of view that anything written so soon after its successful completion may appear old. Those whose lives are devoted to aviation, will discuss the flight in a different way from the public. Lindbergh will be credited by them with even more nerve than the great admiring throngs who admire grit and stamina in whatever field it is shown. It is safe to say that those who have closely followed aviation have had serious misgivings as to the physical endurance required to pilot a plane for over thirty hours. The well-known effect of the droning of the engine as a sleep producer was expected to be one of the most difficult problems for Lindbergh to surmount. No records available show any such length of time of piloting by any other aviator. Even if he overcame the sleep element the continuous strain of handling the controls, watching his instruments and maps and taking food were thought to be a strain that would be too great, except for a superman. This the young pilot has proved himself to be and to him is rightfully coming the homage of the world.

* * * *

The New York-Paris flight has probably gone far towards the settlement of the controversy regarding flying by instruments as compared with placing greater reliance on the skill of the pilot. When a plane can be flown from an enclosed cockpit through darkness, fog, rain and over water, with practically the entire guidance from the instrument board, a new chapter has been written in aeronautical history. Heretofore, on long distance oversea flights, much stress has been placed on the necessity of having ships along the route for direction finding as well as for protection. It has also been assumed generally that long hops from continent to continent would require expert navigators. Probably not the least significant of the results of Lindbergh's flight will be to demonstrate that the new aeronautical instruments are sufficient for long distance flying. This, alone, from the standpoint of the progress of the art, is a notable advance, for it has convinced the public, as no other demonstration could, of the great progress made in flying control, and how little air navigation of the future will have to rely on the older forms of navigational aids. Little more need be said concerning the advance in design in engine reliability, in quality of fuel and other evidences of increased range and dependability. They are all too obvious and the manufacturers who contributed to the success of the venture have already been overwhelmed with deserved congratulatory messages. The world is now more convinced than ever before that the United States can build aircraft of great airworthiness, engines that will function as long as fuel lasts and fuel that has as good quality "to the last drop" as at the beginnings of the flights.

* * * *

But the outstanding advantage of the flight is the effect of such efforts on international good-will. We have mentioned this recently in connection with the Four-Continent tour of Colonel de Pinedo and the Pan-American Flight. Italy has gained great prestige from the unparalleled achievements of Colonel de Pinedo in all the countries of the world that he has visited. In South America, the visit of Major Dargue has created a sentiment that will make for cordial relations as no other visit could. The visits of diplomats only reach official circles, but the arrival of aircraft appeals to the imagination of all the people. And it is this great enthusiasm that has been aroused in all parts of the world, over the exploit of the heroic lonely twenty-five year old commercial pilot that will bring to the attention of all governments the value to nations of this new form of accomplishment. Fabulous sums are being mentioned in connection with the rewards to Lindbergh from the flight. This will be insignificant compared to the value of his success to the prestige of the American people. No visit of a fleet, no international sporting event nor even the honor accorded to royalty, as they travel on missions of international friendship, can compare with the worldwide acclamation that is being given to this modest commercial pilot from the Mississippi Valley.

* * * *

Commercial pilots will also have a feeling of elation over the successful cross-country and oversea flight from San Diego to Paris. Practically all previous epoch making flights with the possible exception of Sir Alan Cobham's, have been made with governmental aid and cooperation. The pilots have been service trained and the services have rightfully taken the reflected credit. But in the case of Lindbergh we have a pilot who, while trained by the Army Air Corps and a member of the reserves, has gained his practical cross-country experience as a pilot over a contract air mail route. This class of flying will probably be the real training field for the cross country flier of the future. Even the government pilots on the Air Mail routes do not receive experience of as great value as the pilots of the contract air mail routes, for here, not only are regularity and dependability required but it is of the utmost importance that the equipment be conserved. Lindbergh received exactly the sort of training that should have brought him success and every commercial pilot in the United States will be glad that one of his group was able to become one of the world's greatest pathfinders.

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CONTINUED

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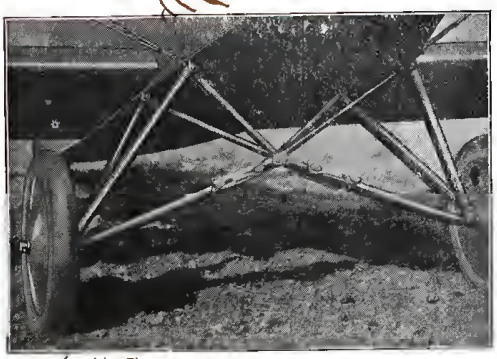

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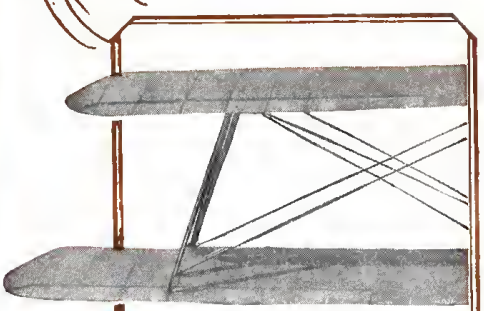

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